Estudio de vulnerabilidad, adaptación y mitigación al Cambio Climático para proyectos hidroeléctricos

Informe técnico sobre el impacto hidrológico del Cambio Climático en las cuencas de estudio

Fase IV y V

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Costa Rica

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UNIVERSITAT POLITÈCNICA DE CATALUNYA

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9 de marzo de 2015

CLASIFICACIÓN

CONFIDENCIAL

Esta página ha sido dejada en blanco intencionadamente para facilitar la paginación de la impresión a doble cara.

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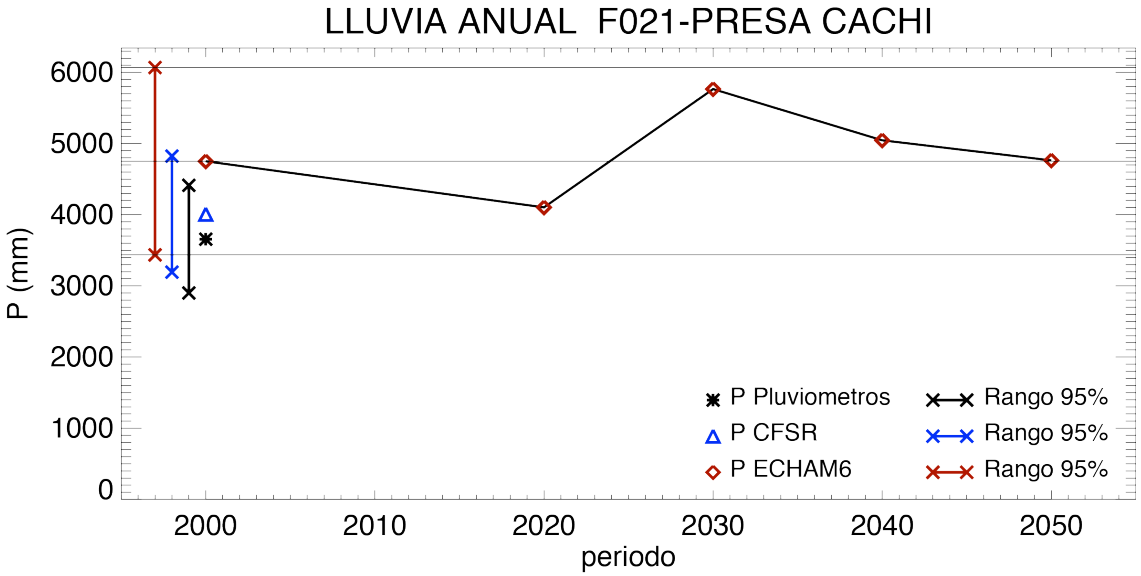
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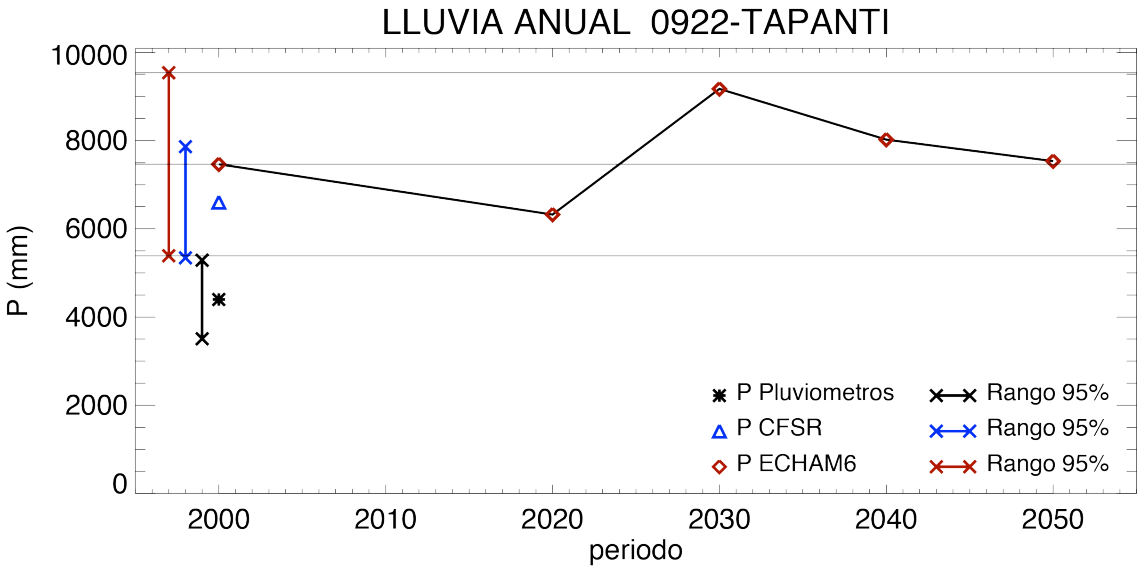
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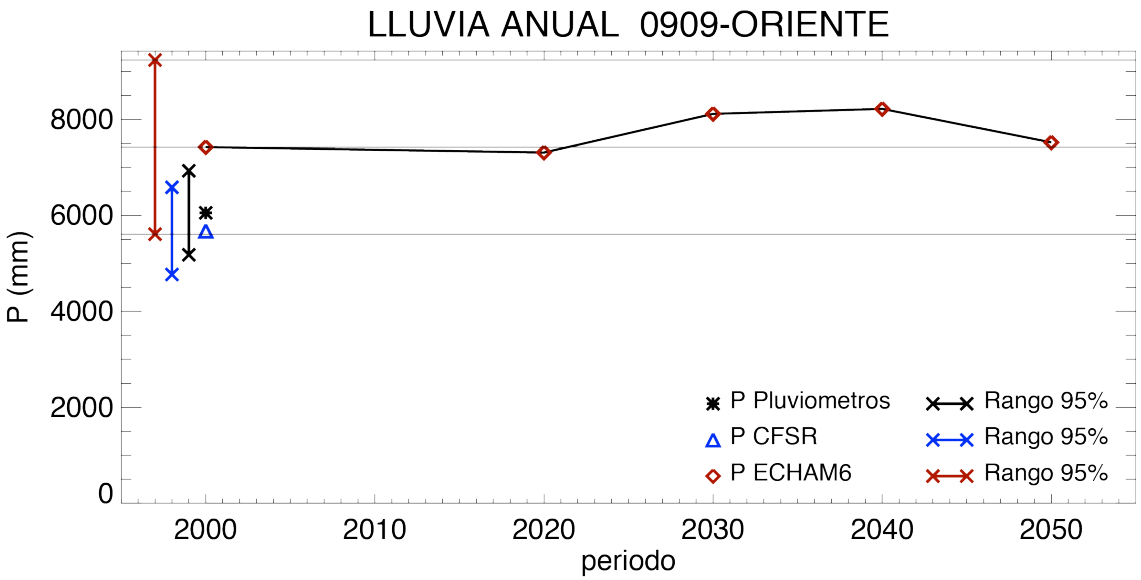
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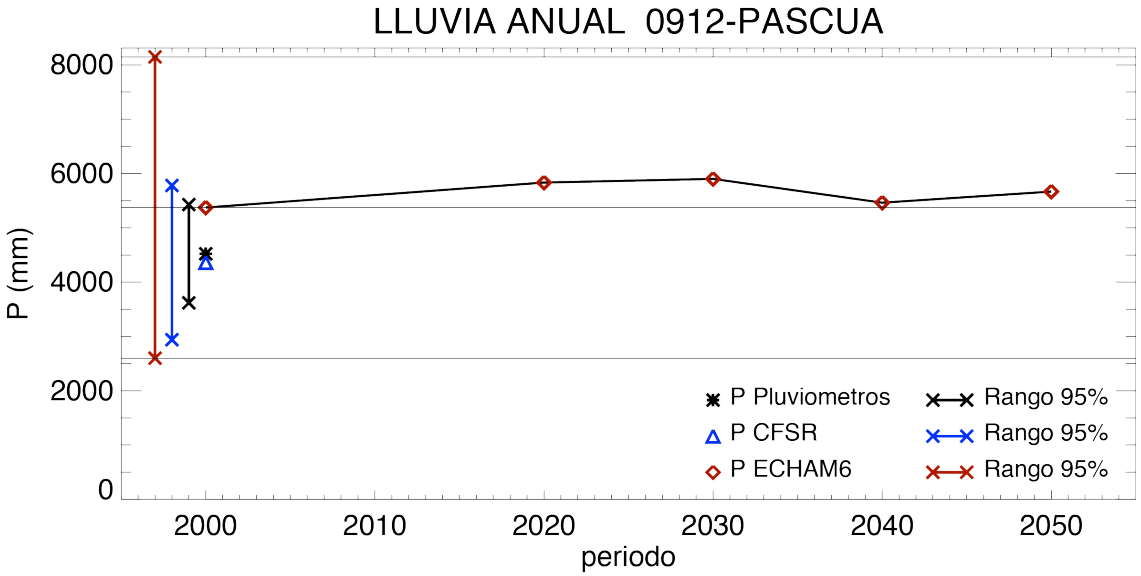
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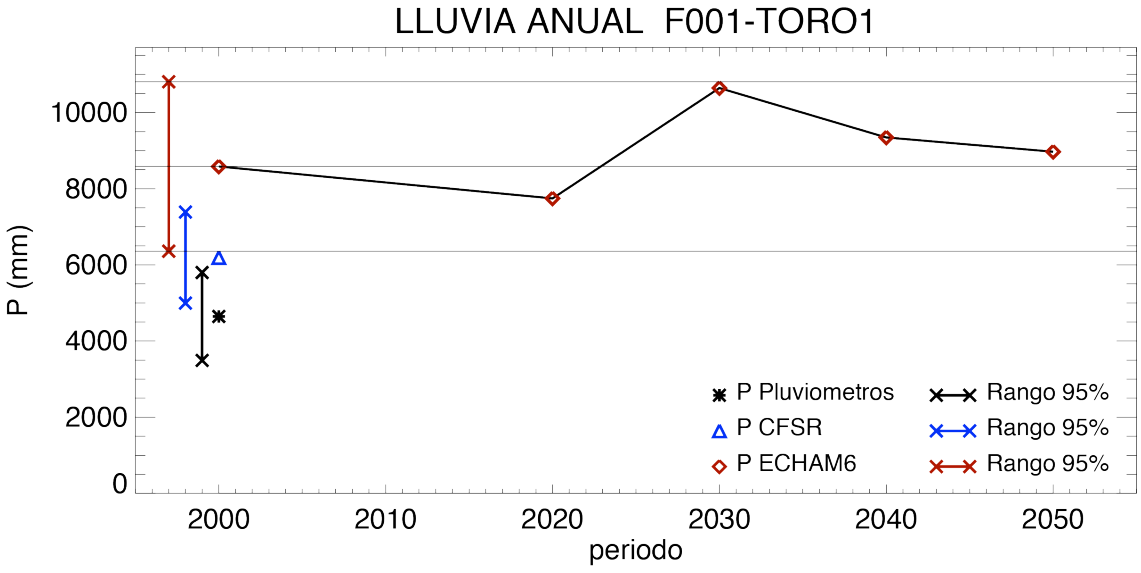
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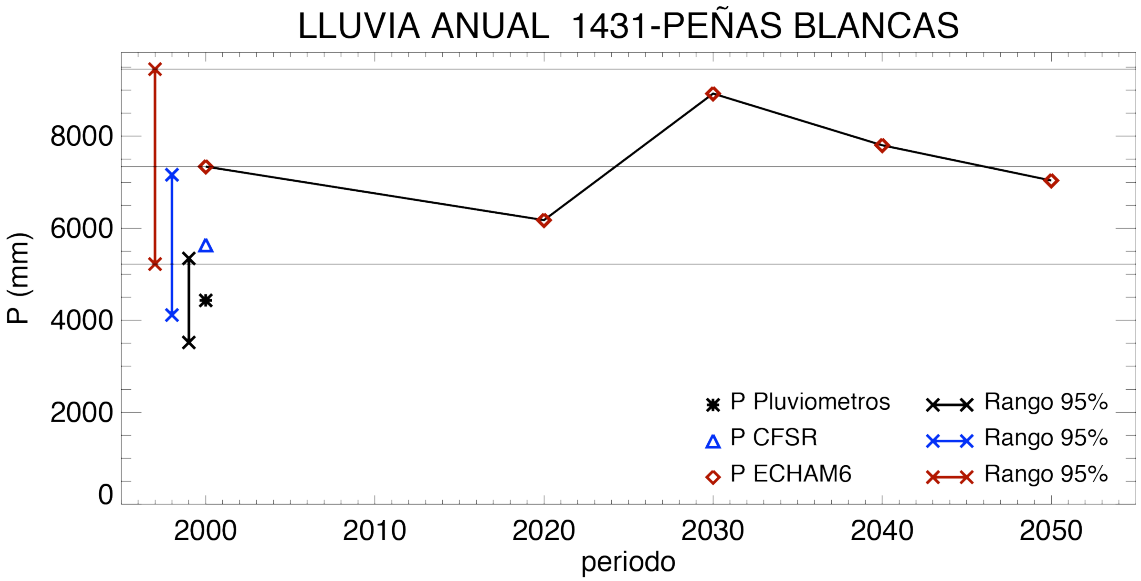


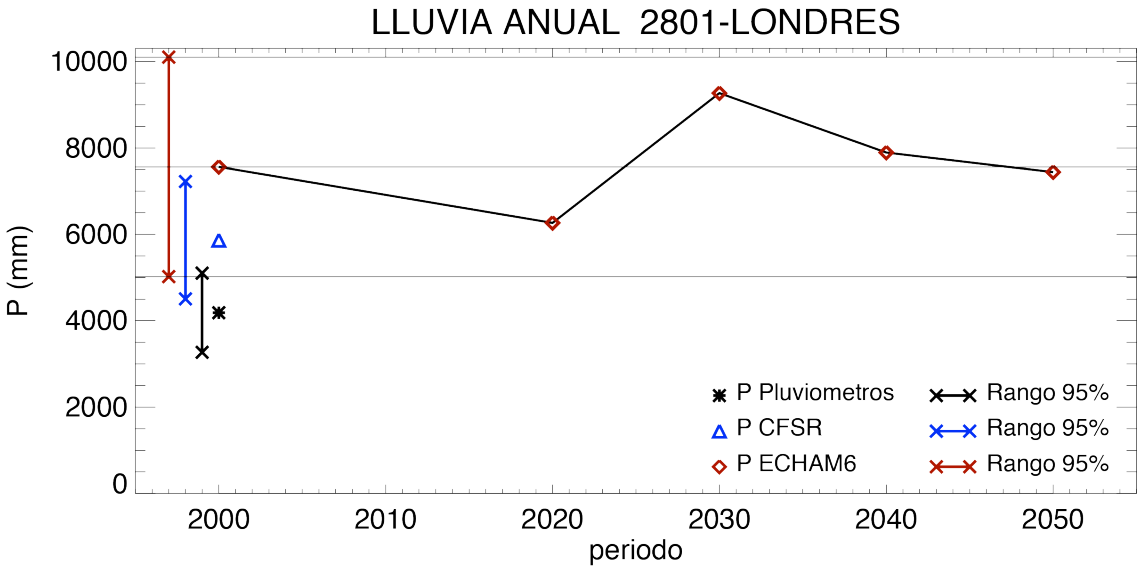


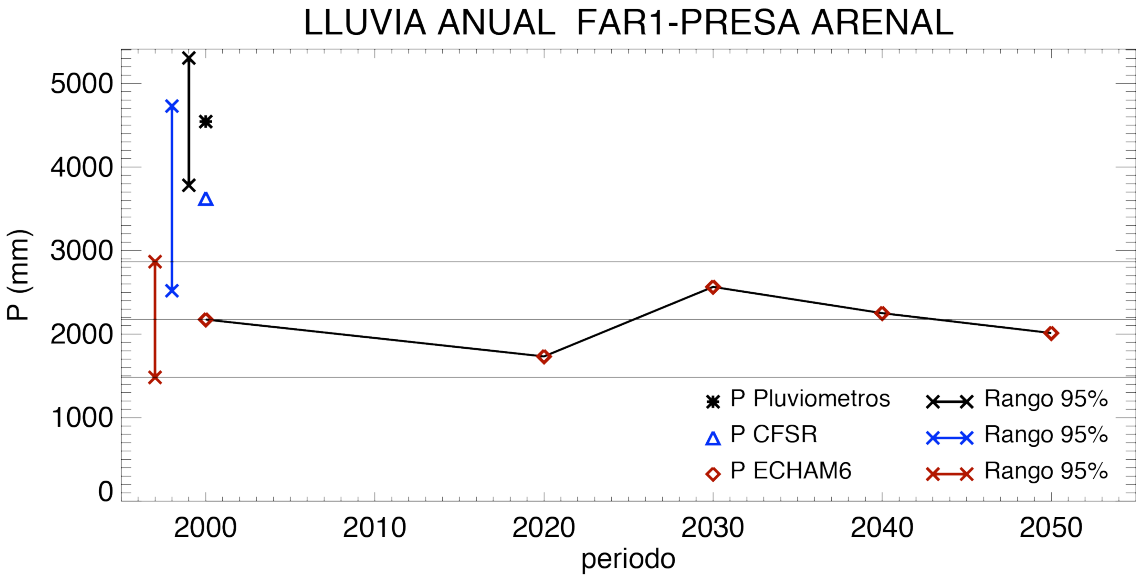

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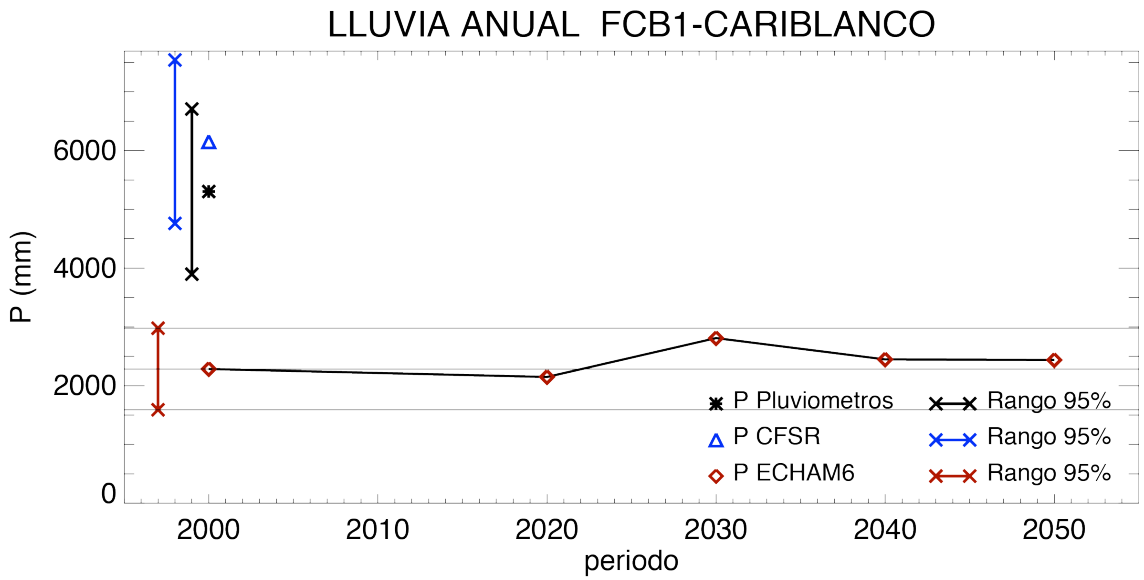

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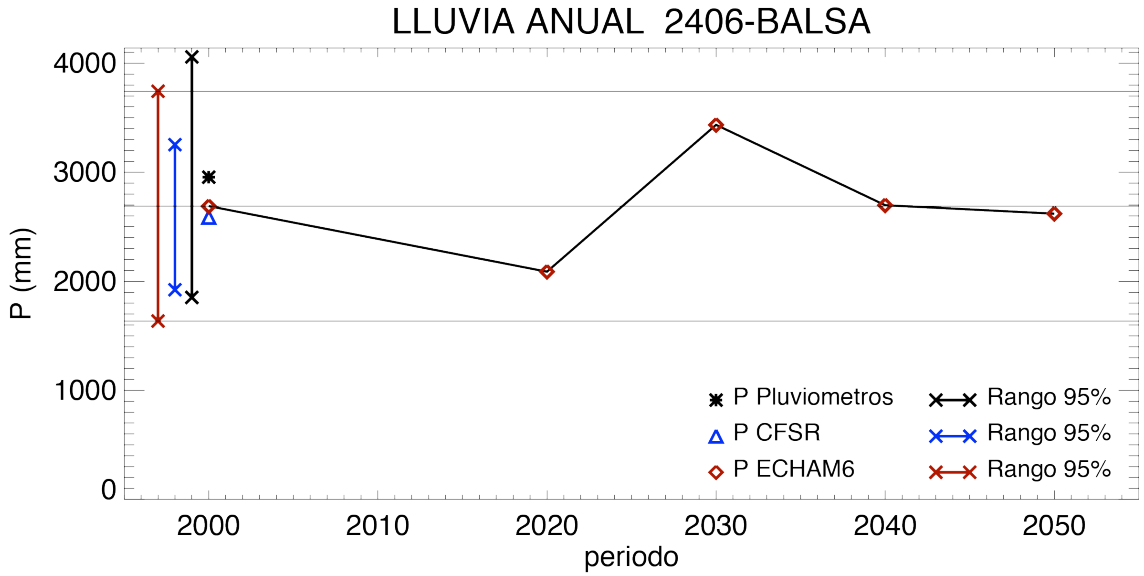

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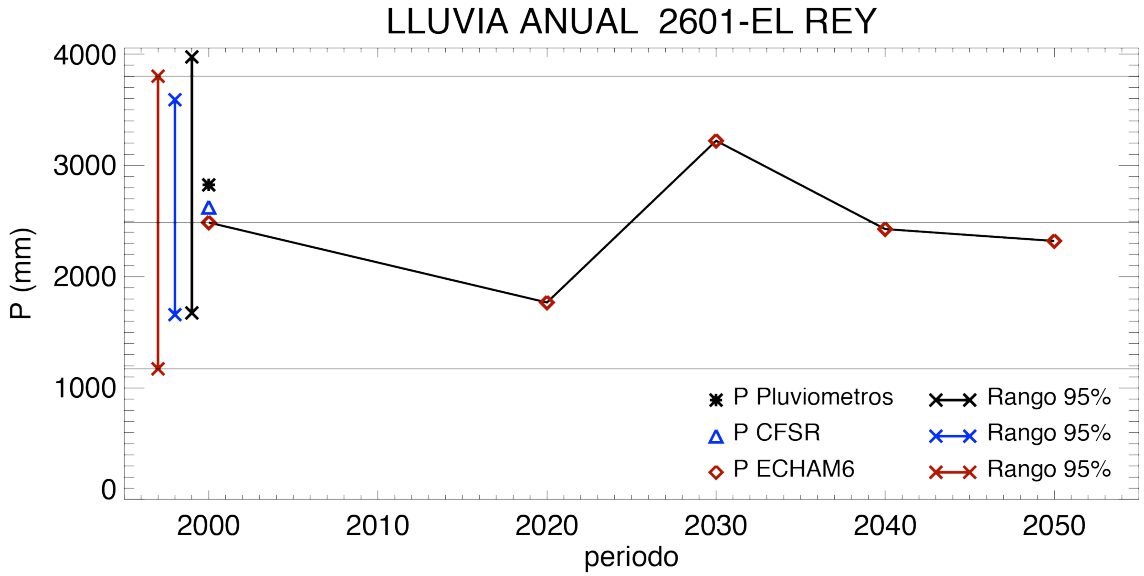

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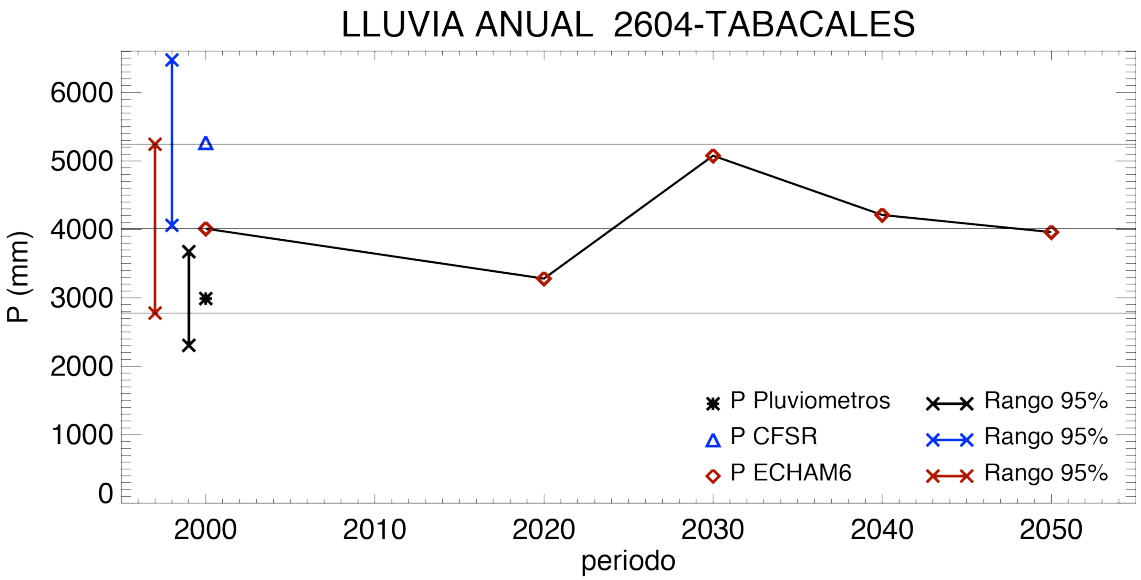

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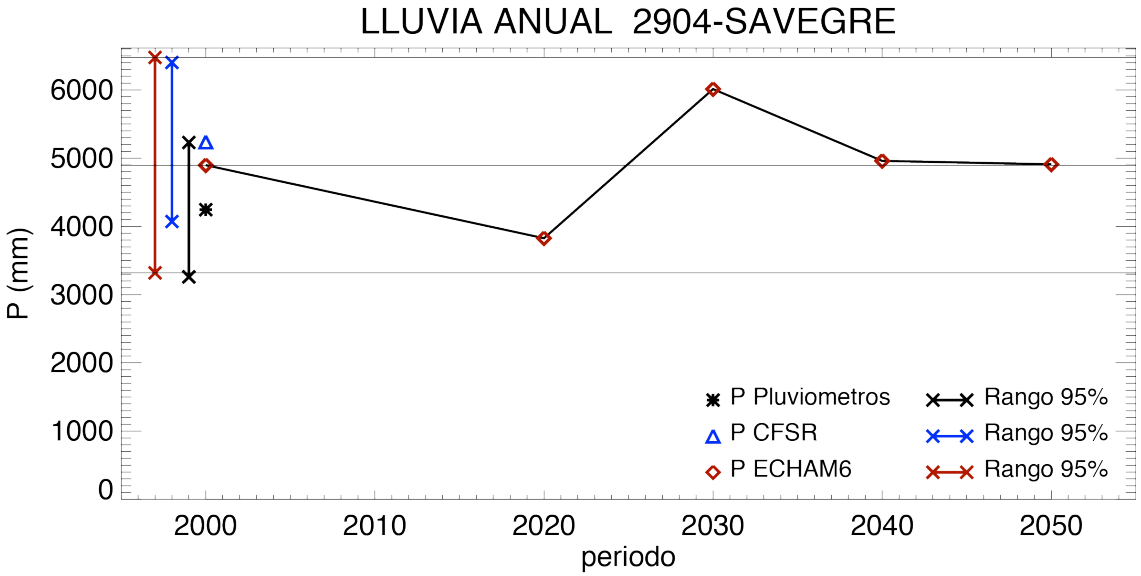

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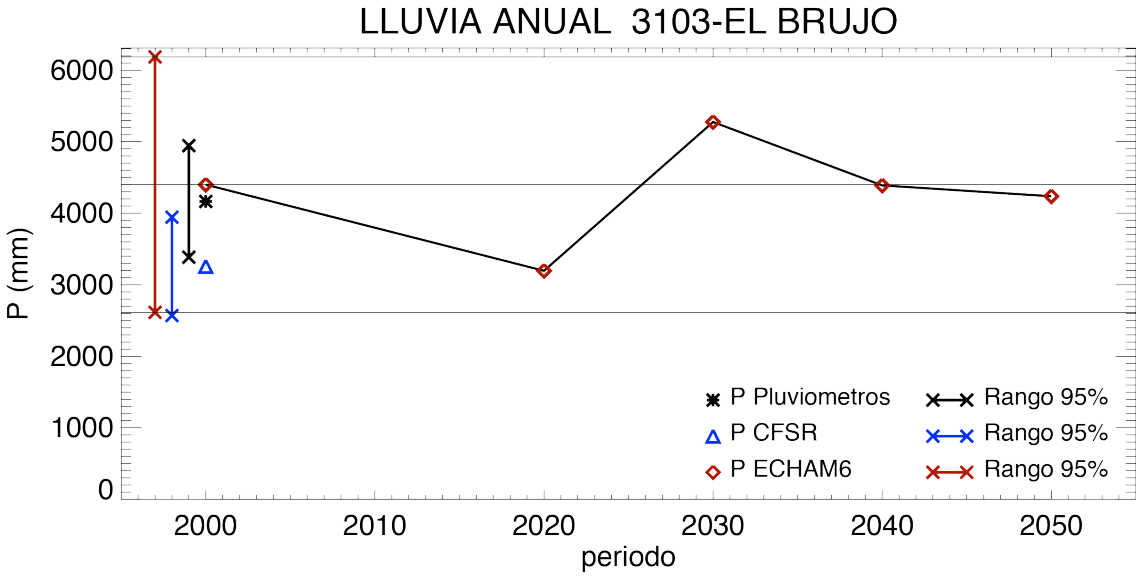

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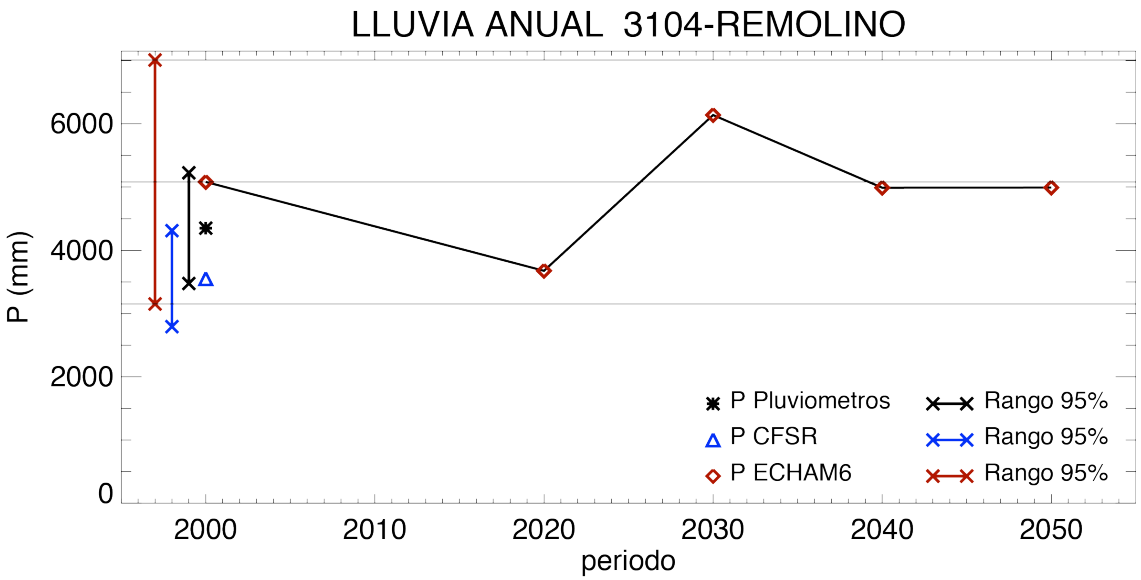

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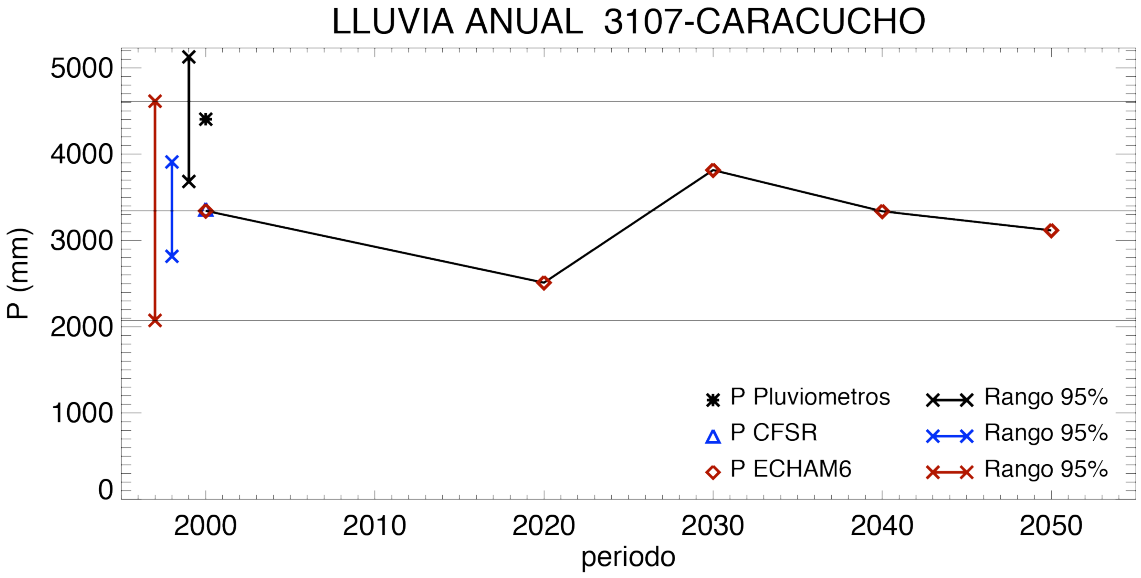

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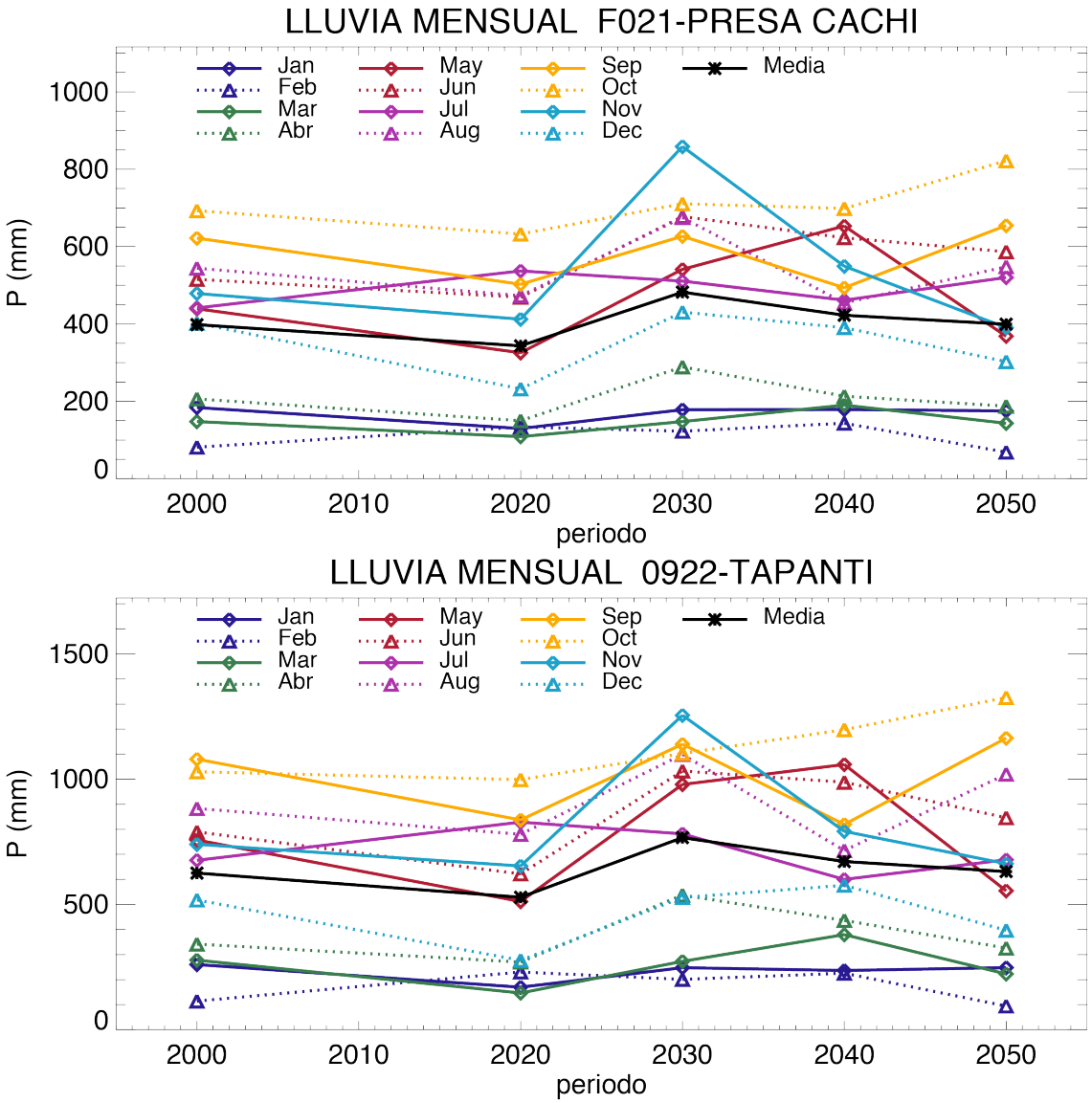

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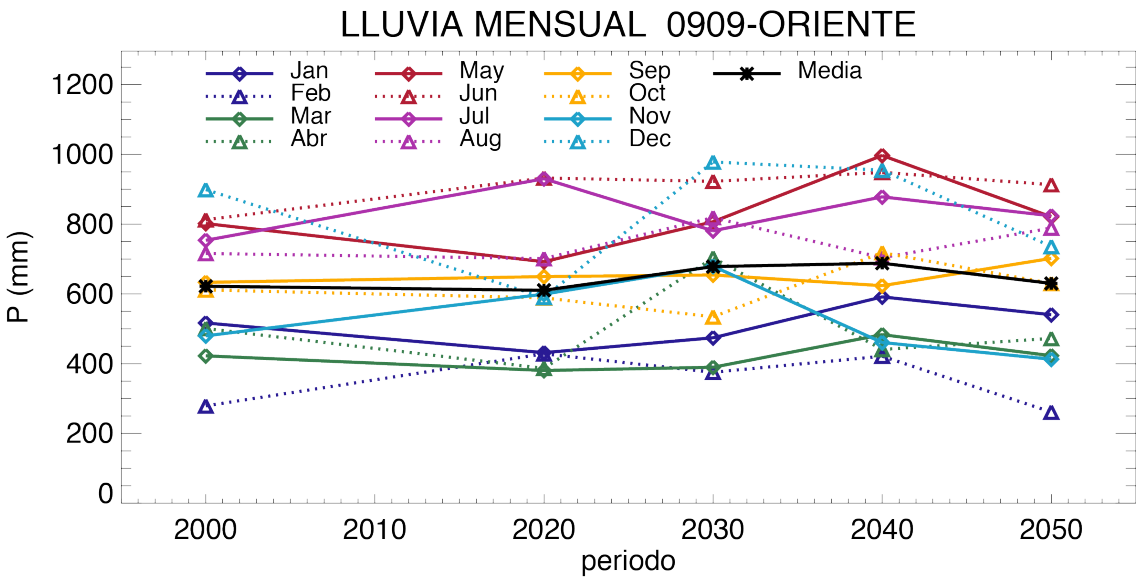

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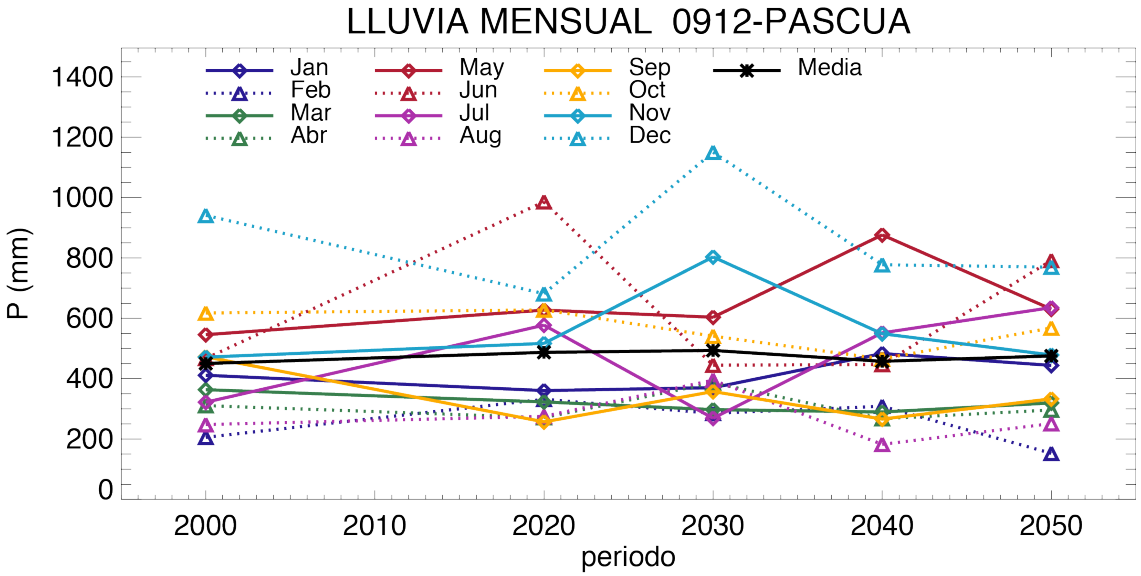

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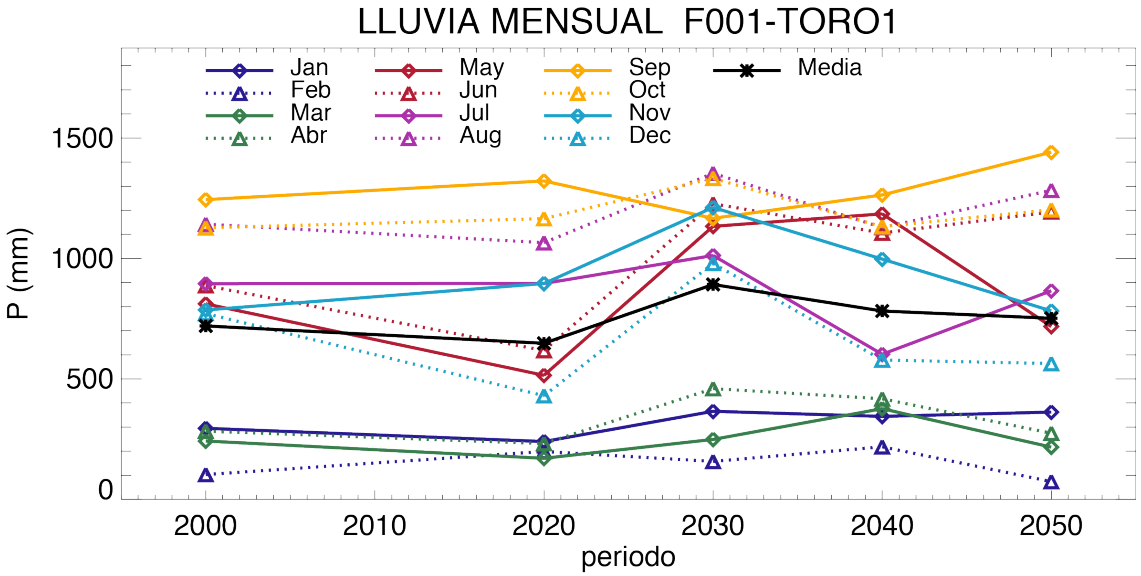

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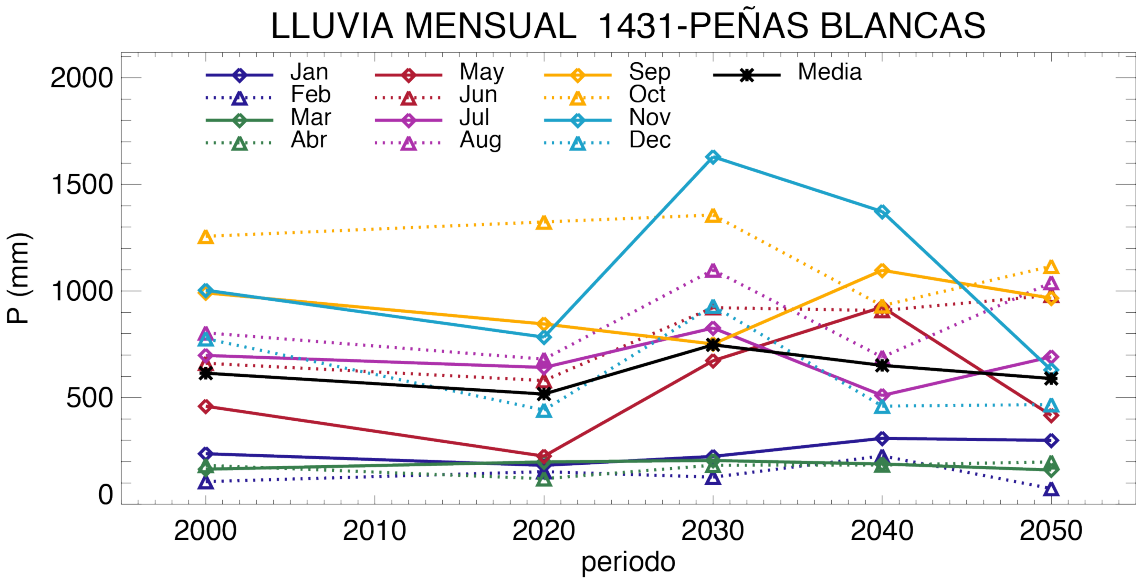
Anejo 2: Figuras de lluvia mensual de cuenca

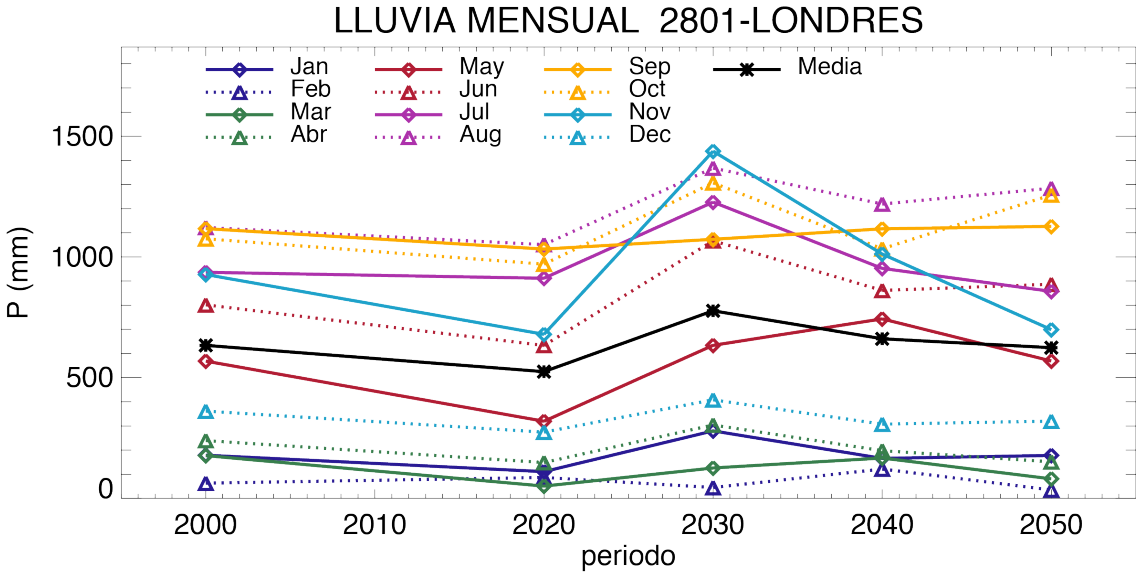


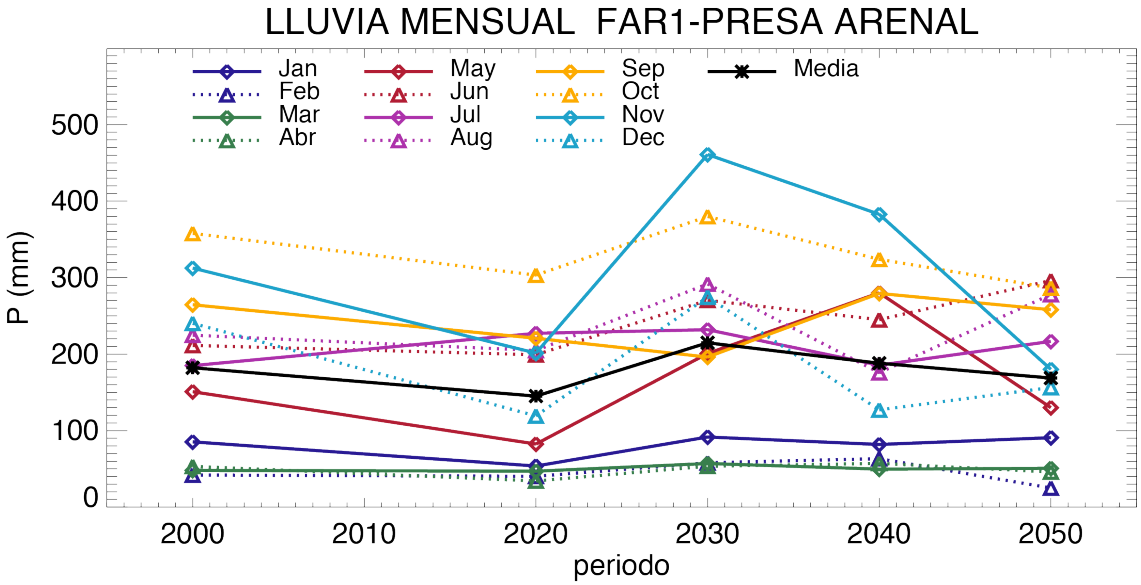

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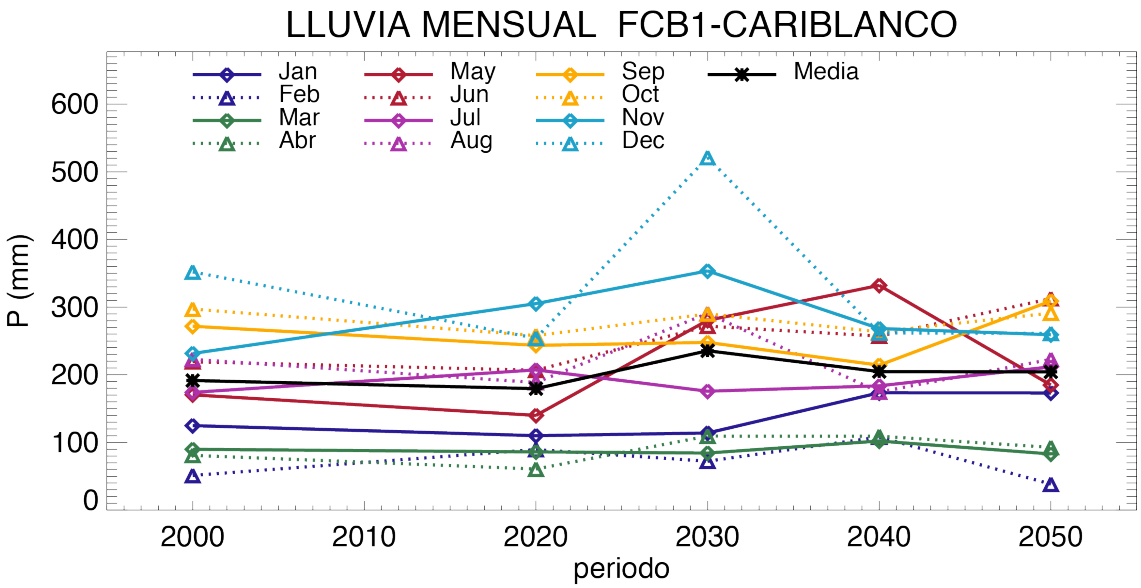

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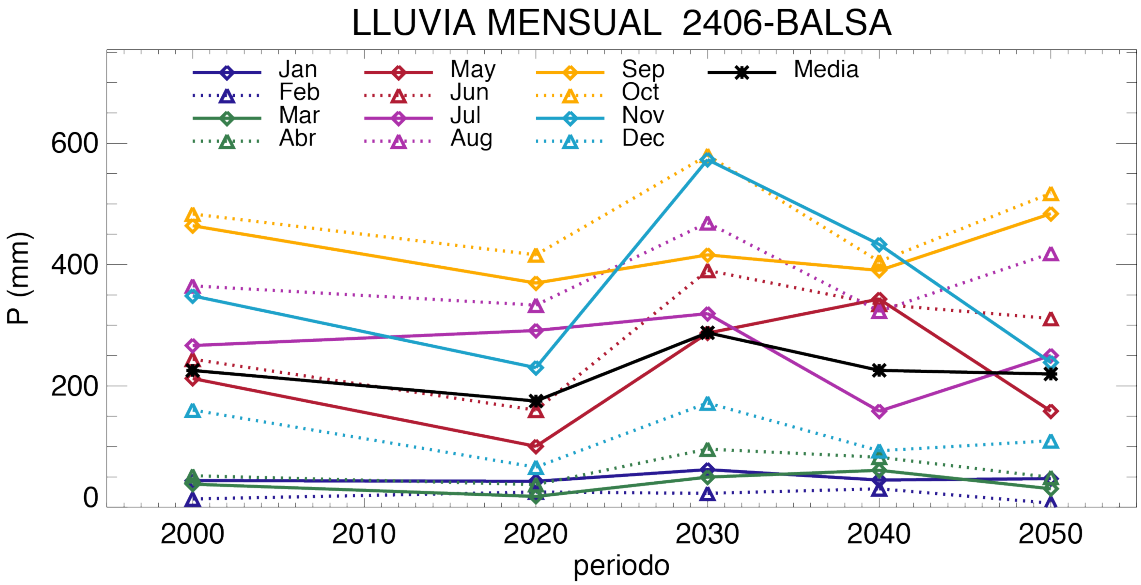

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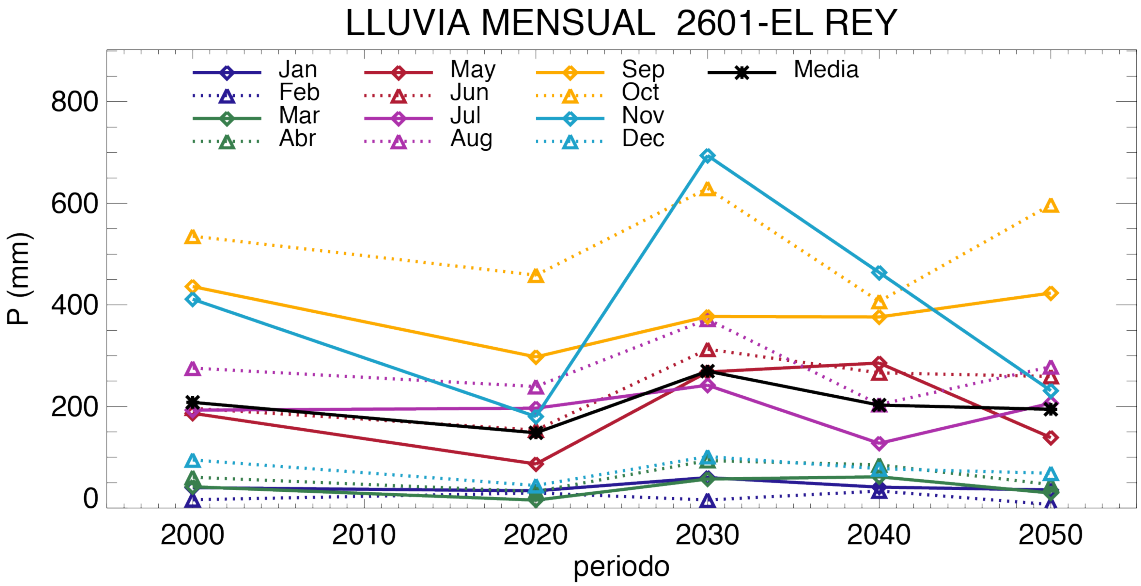

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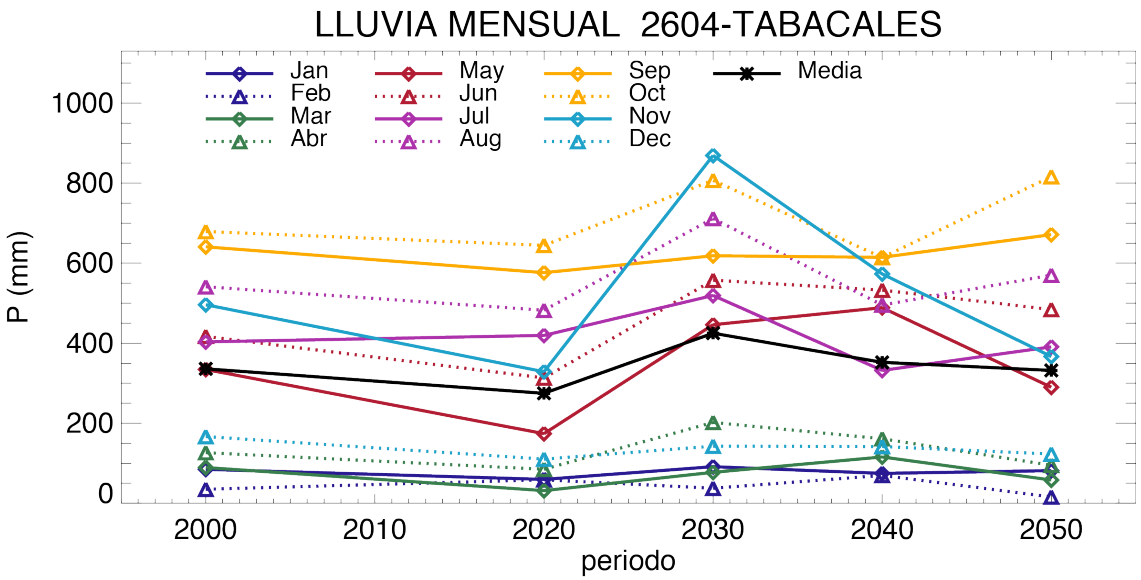

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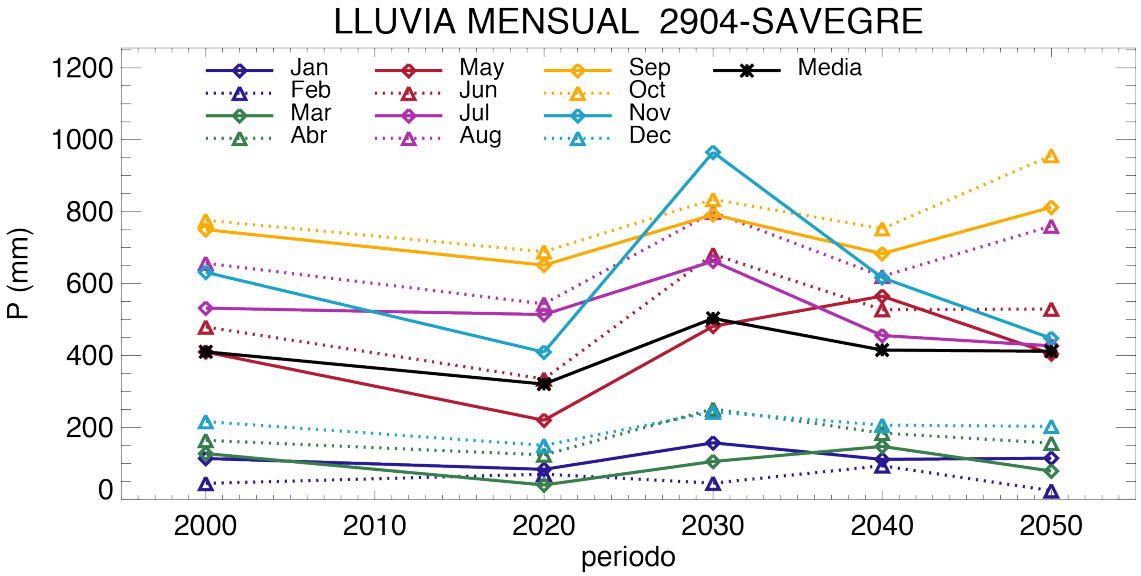

LLUVIA MENSUAL FAR1-PRESA ARENAL
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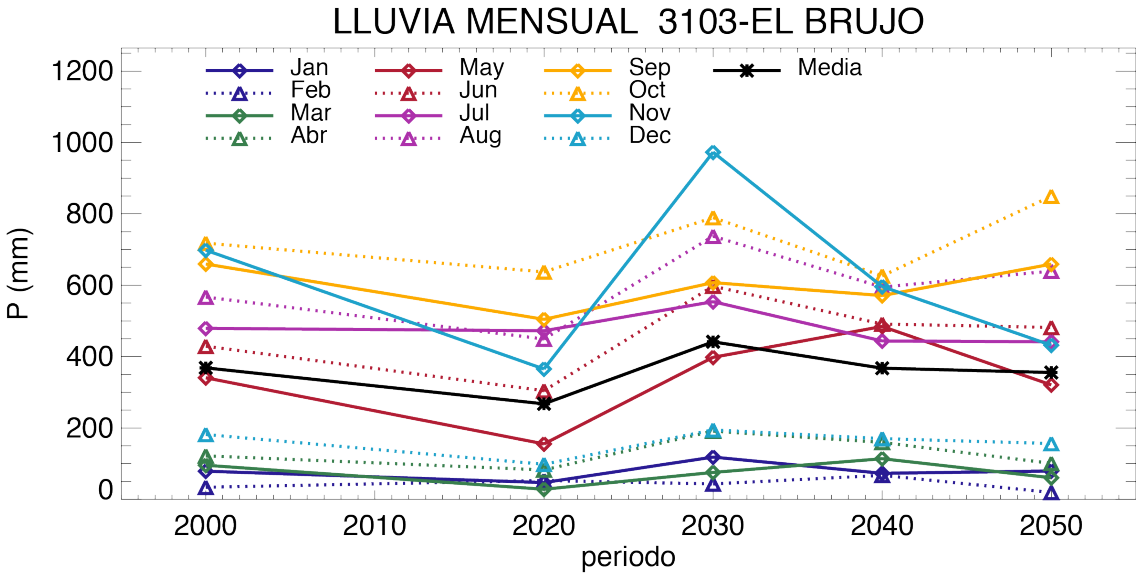

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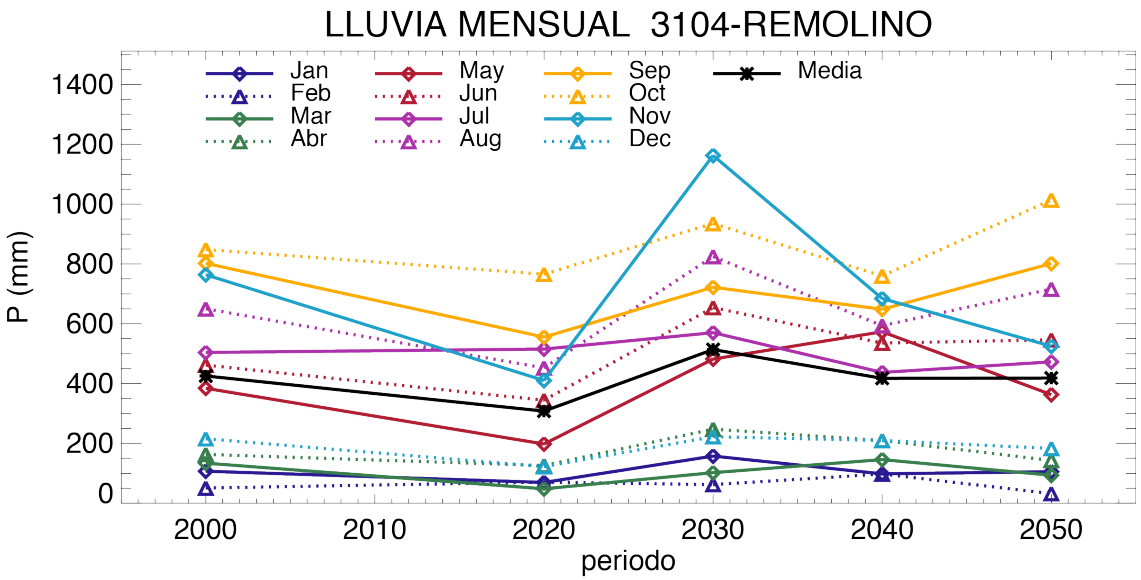

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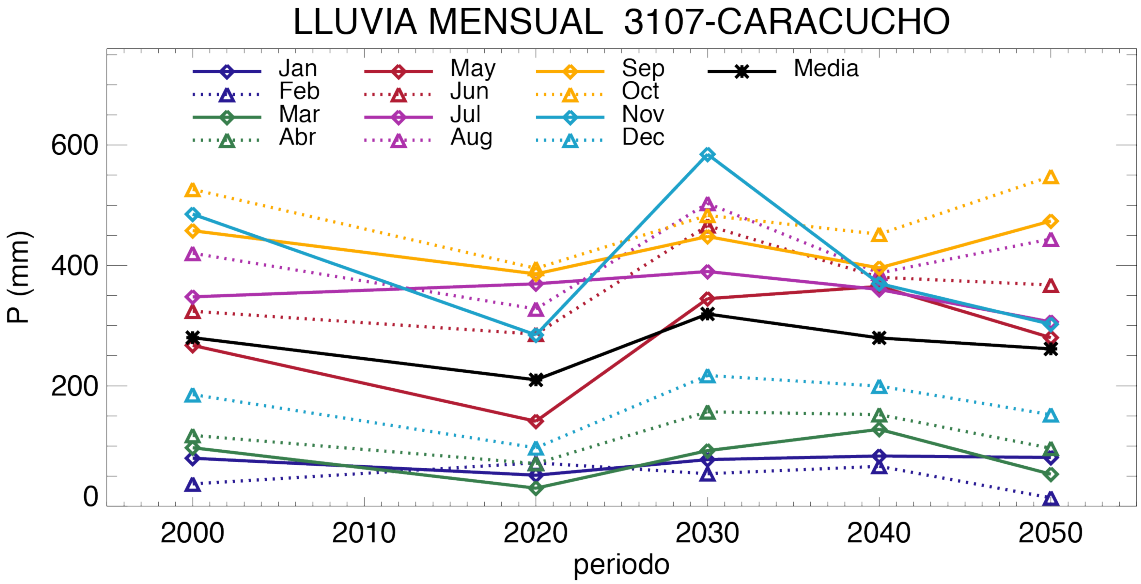

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LLUVIA MENSUAL 2604-TABACALES
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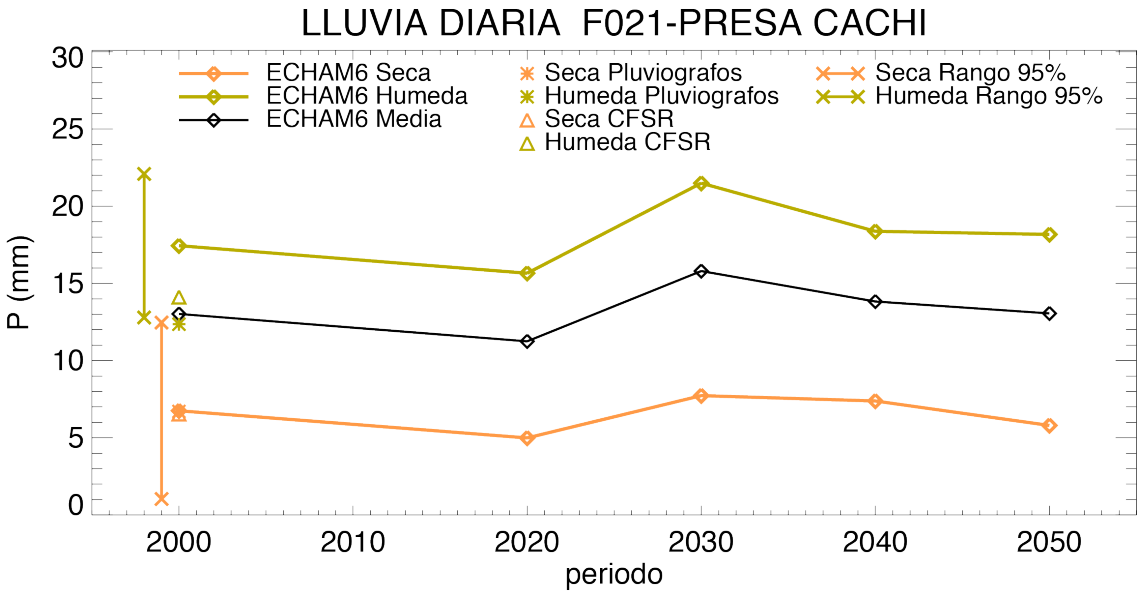

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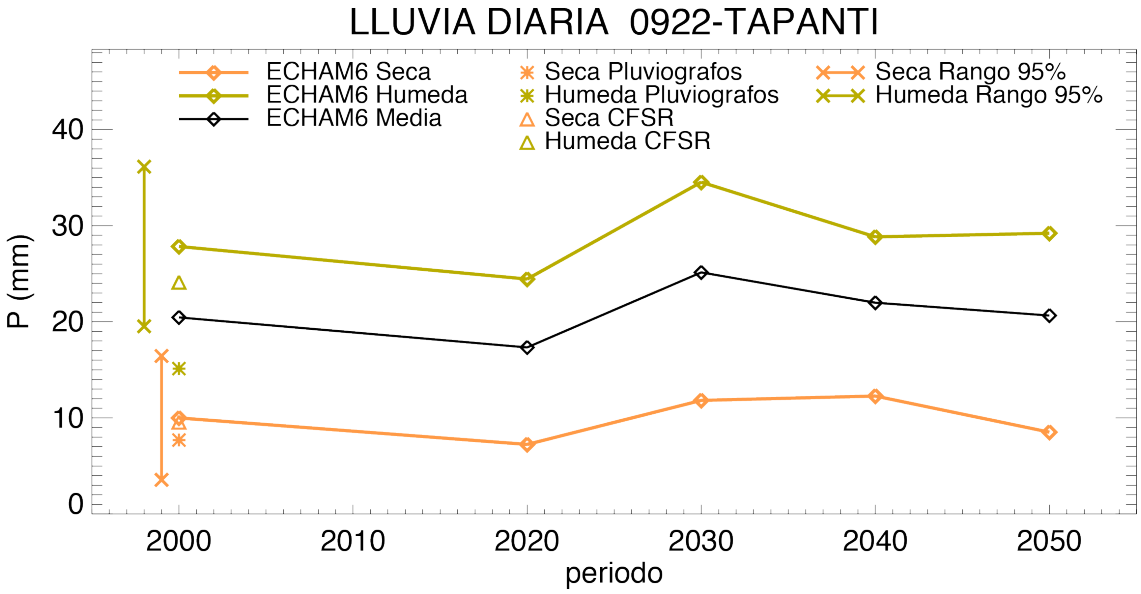

LLUVIA MENSUAL 3103-EL BRUJO
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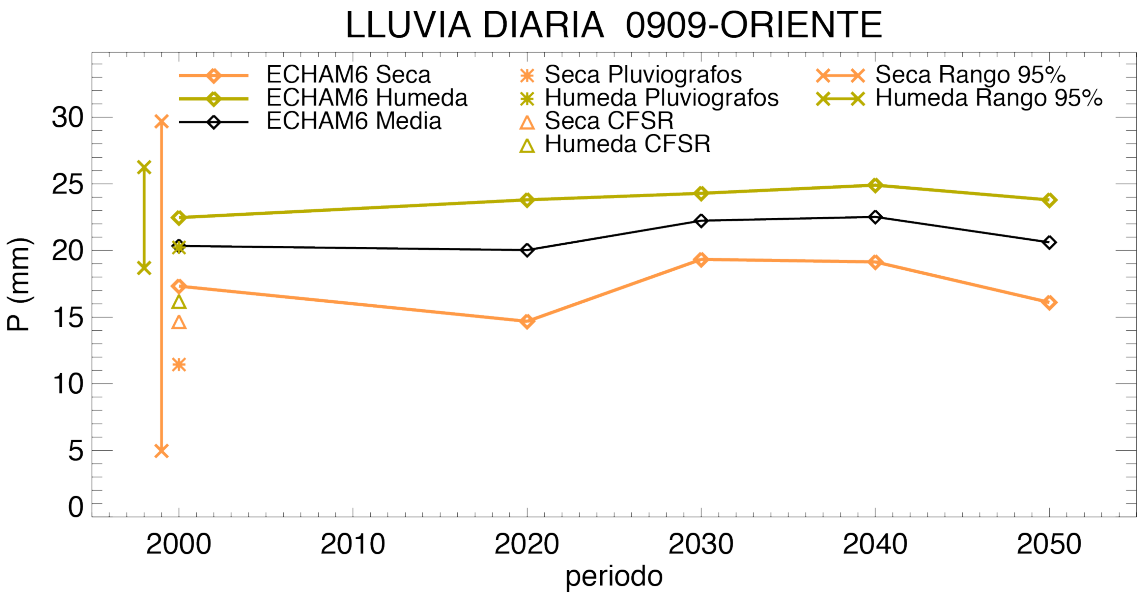

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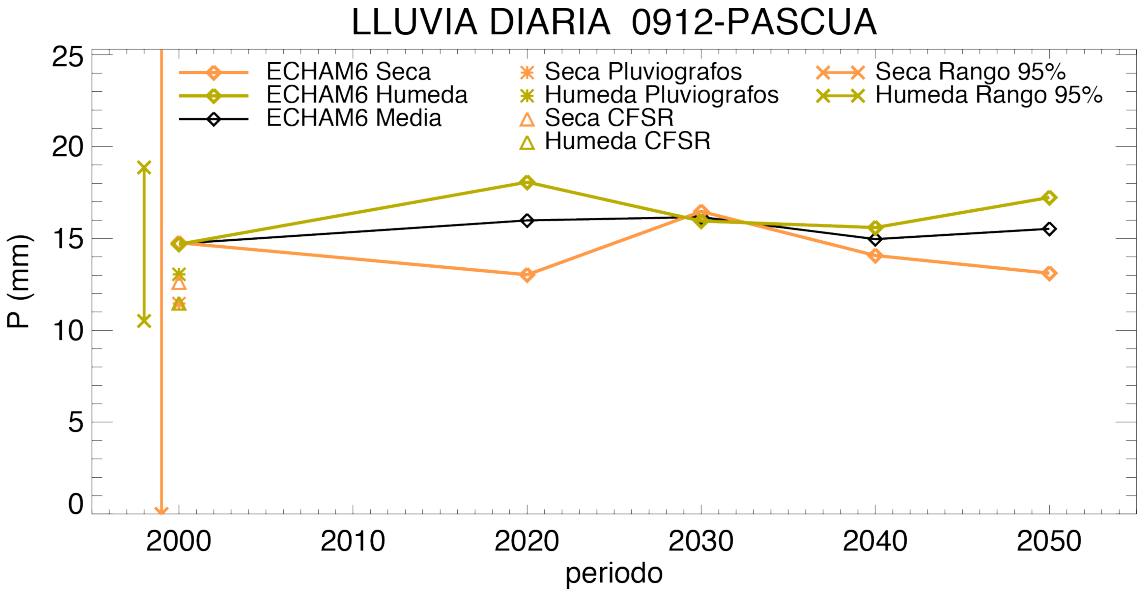

LLUVIA MENSUAL 3107-CARACUCHO
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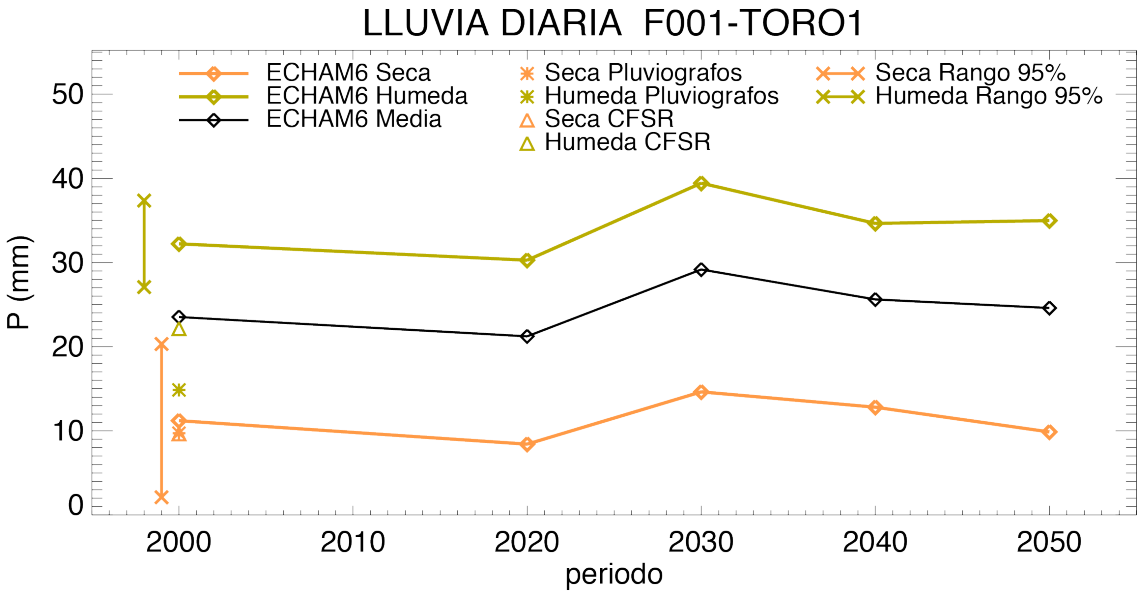
Anejo 3: Figuras de lluvia diaria de cuenca para época seca y época húmeda

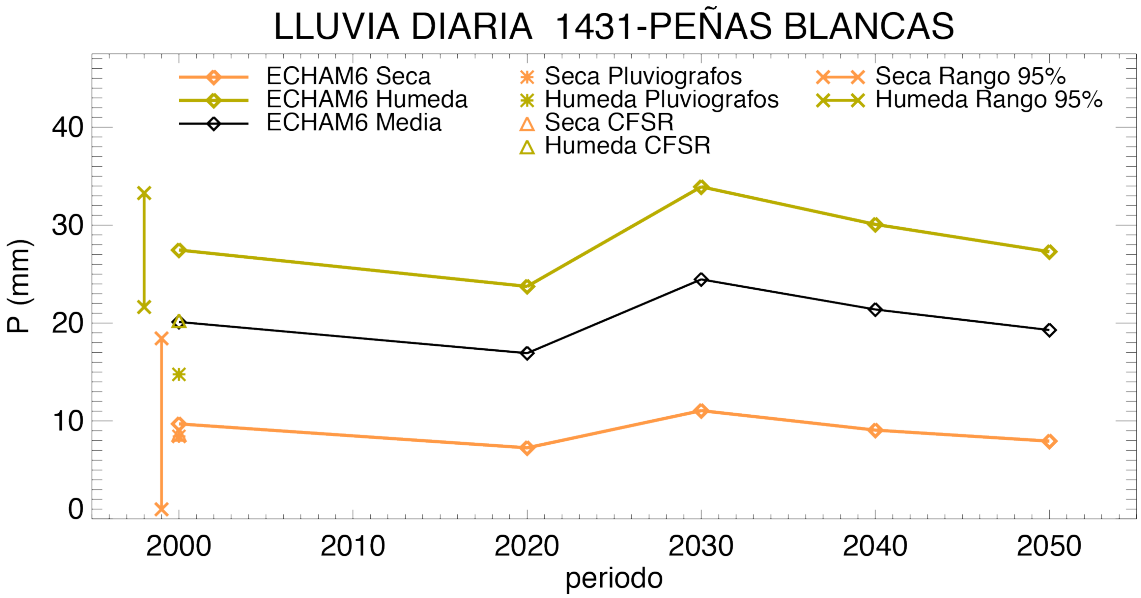


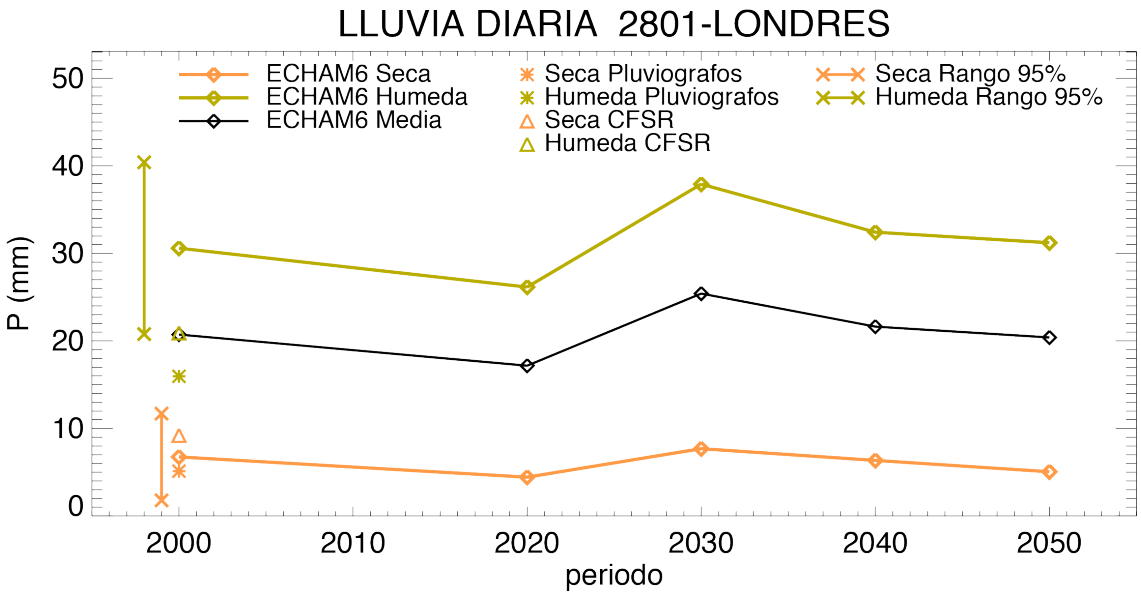


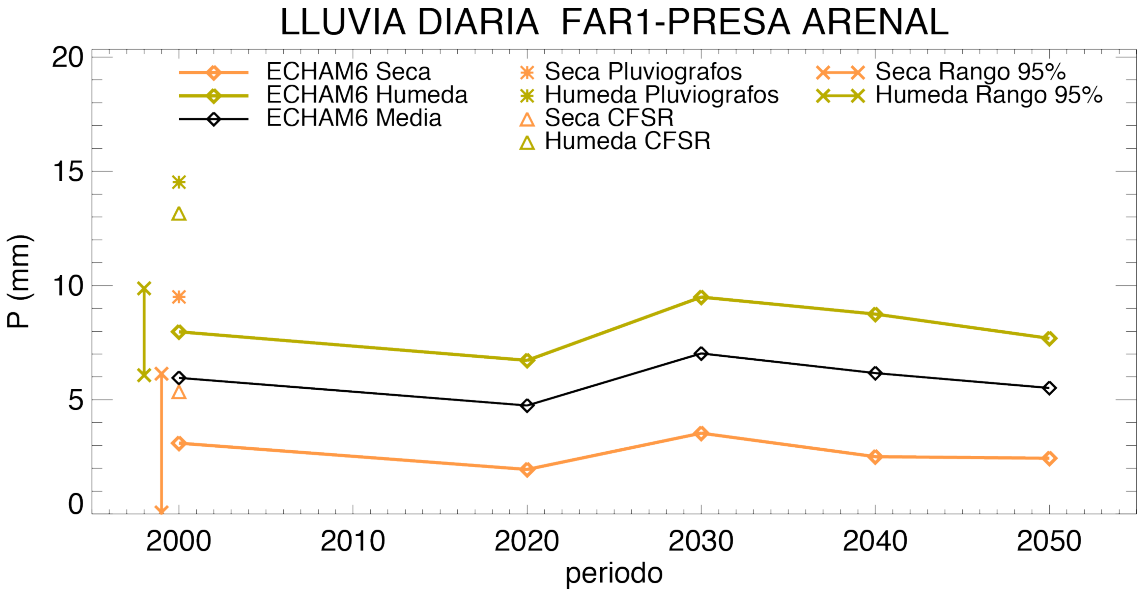

LLUVIA DIARIA 0909-ORIENTE
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
5
10
15
20
25
30
2000
2010
2020
2030
2040
2050

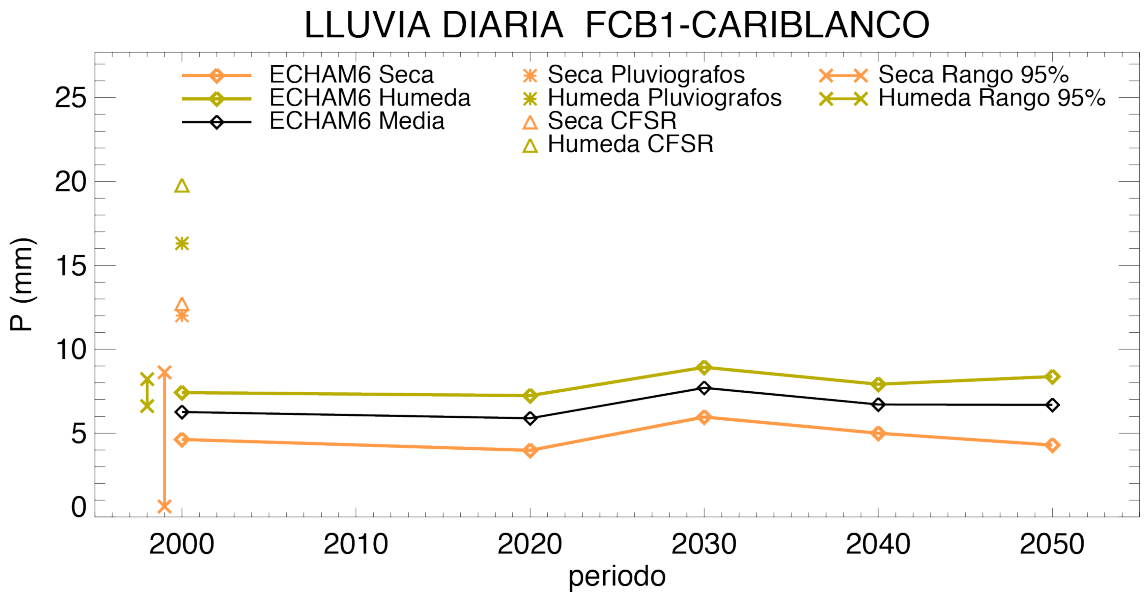

LLUVIA DIARIA 0912-PASCUA
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050

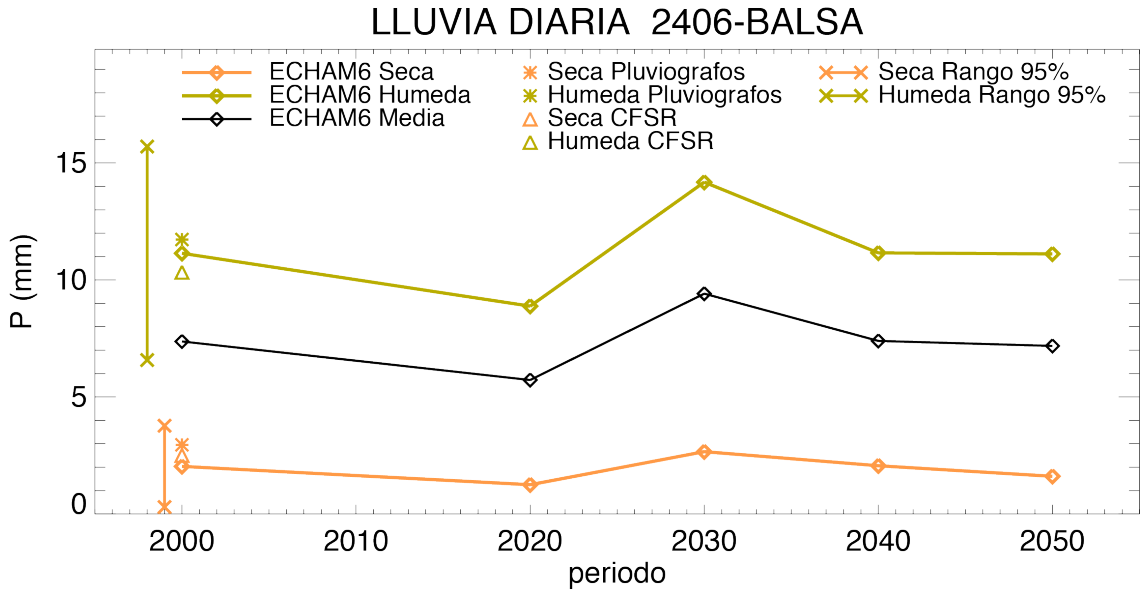

LLUVIA DIARIA F001-TORO1
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
10
20
30
40
50
2000
2010
2020
2030
2040
2050

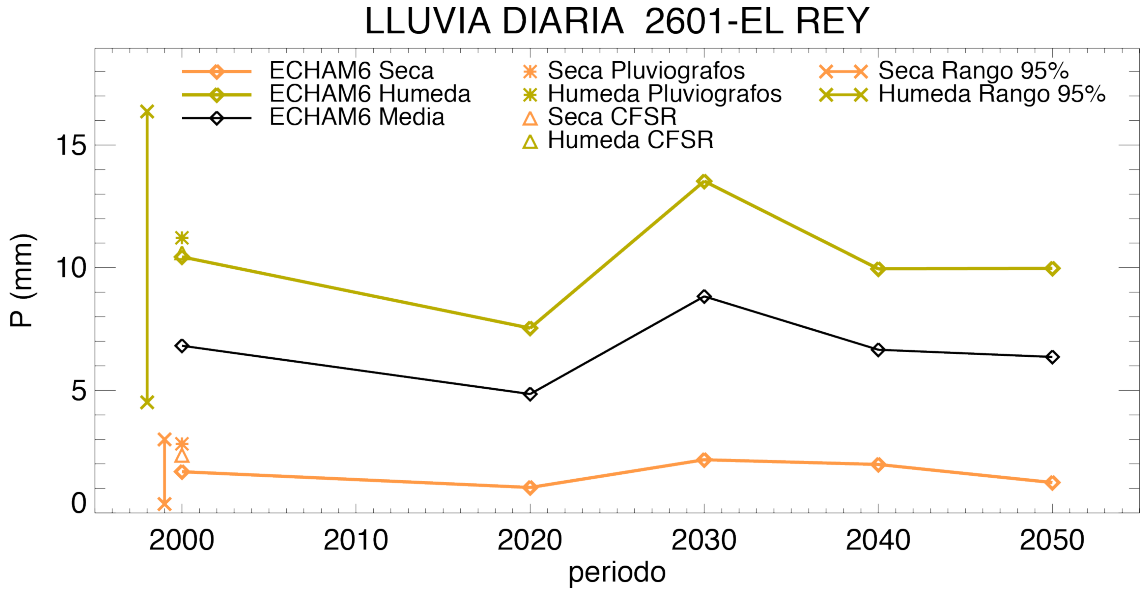

LLUVIA DIARIA 1431-PEÑAS BLANCAS
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
10
20
30
40
2000
2010
2020
2030
2040
2050

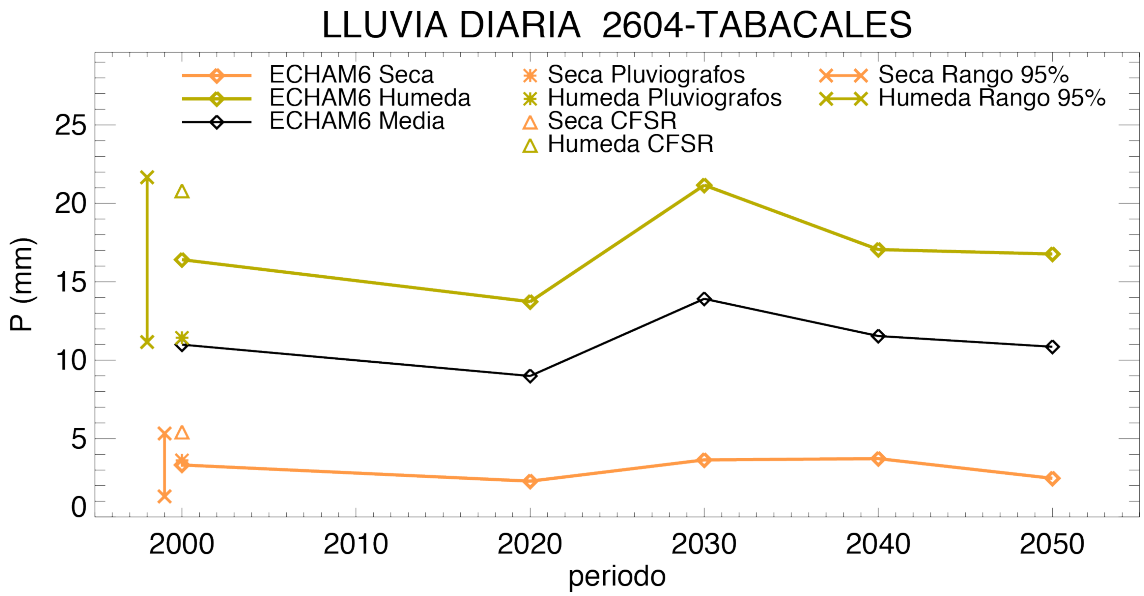

LLUVIA DIARIA 2801-LONDRES
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
10
20
30
40
50
2000
2010
2020
2030
2040
2050

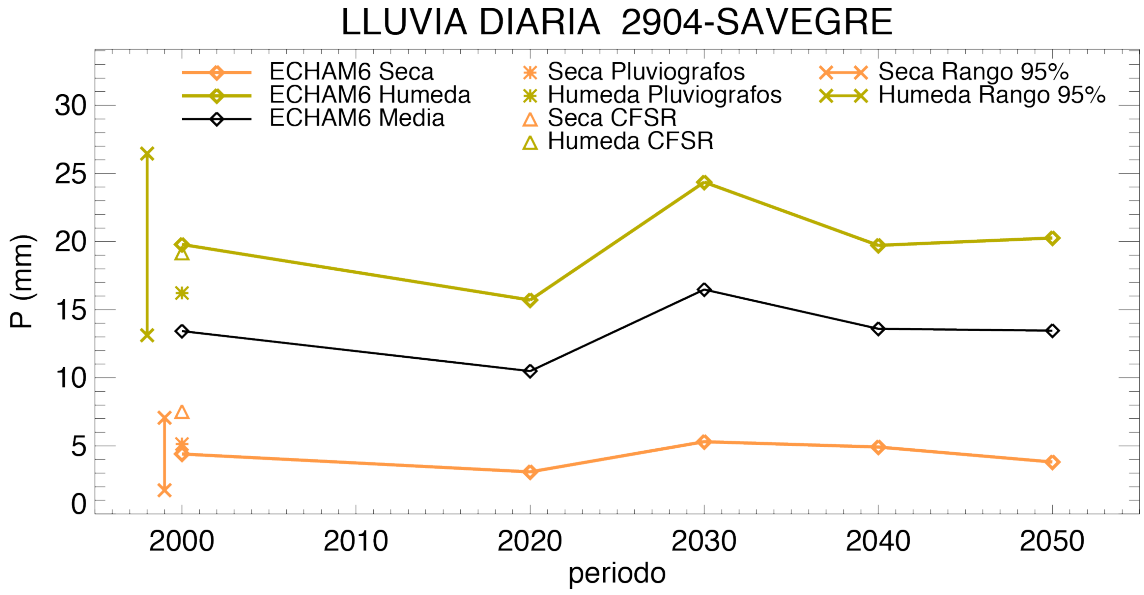

LLUVIA DIARIA FAR1-PRESA ARENAL
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
5
10
15
20
2000
2010
2020
2030
2040
2050

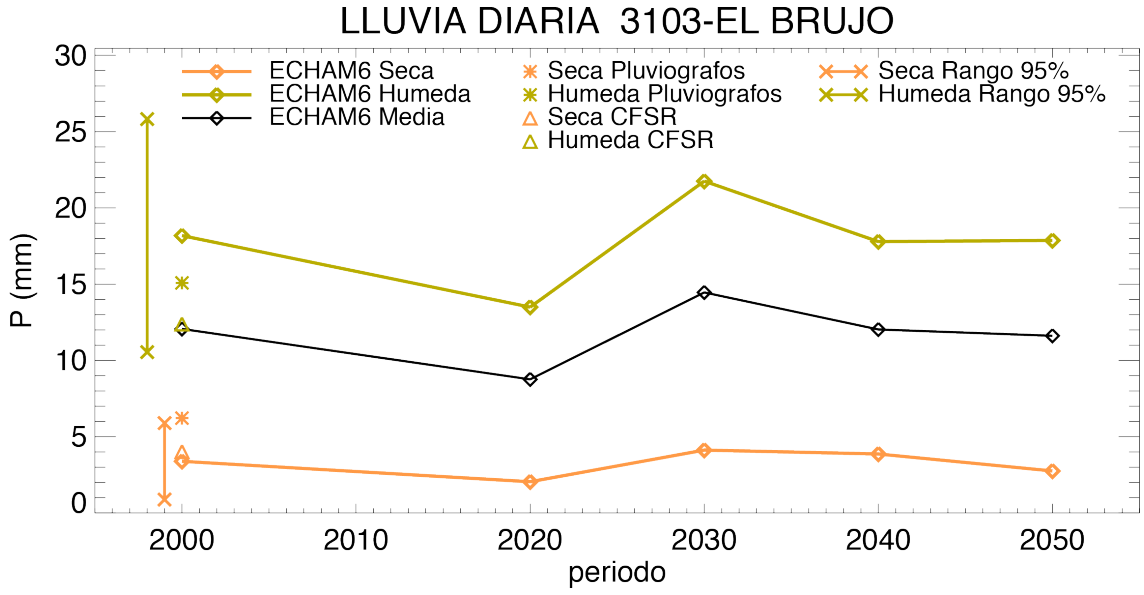

LLUVIA DIARIA FCB1-CARIBLANCO
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050
periodo

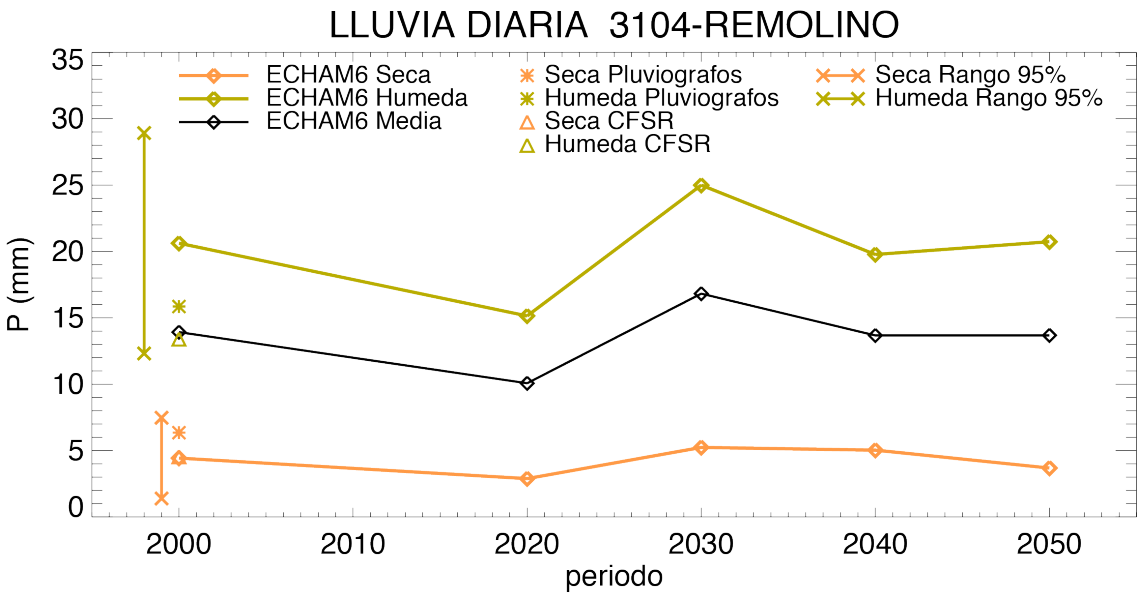

LLUVIA DIARIA 2406-BALSA
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
2000
2010
2020
2030
2040
2050
periodo

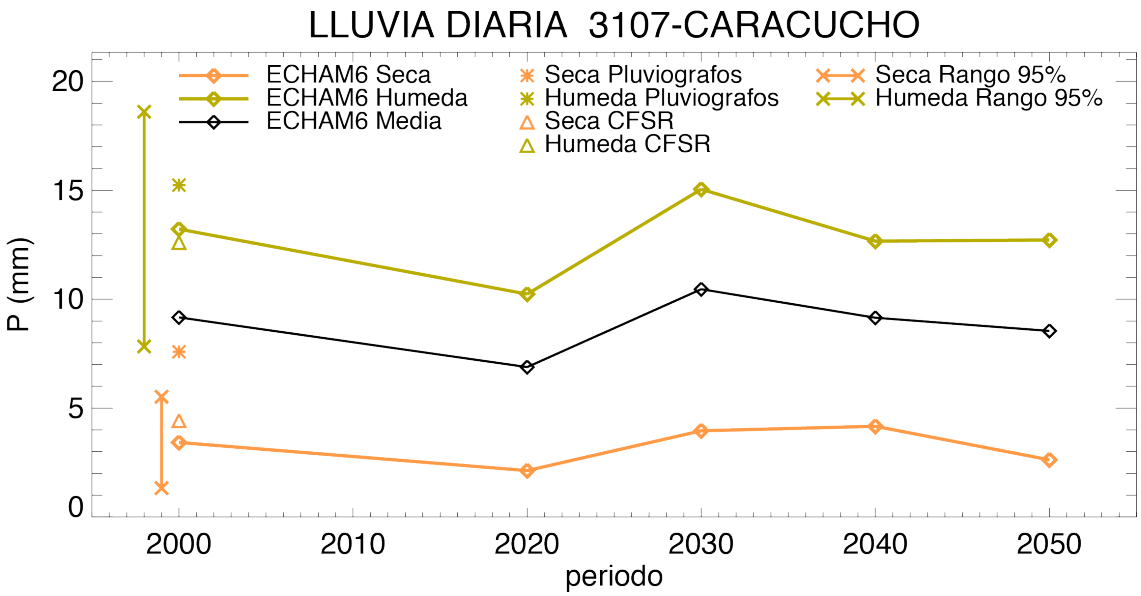

LLUVIA DIARIA 2601-EL REY
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
2000
2010
2020
2030
2040
2050
periodo


LLUVIA DIARIA 2604-TABACALES
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050
periodo

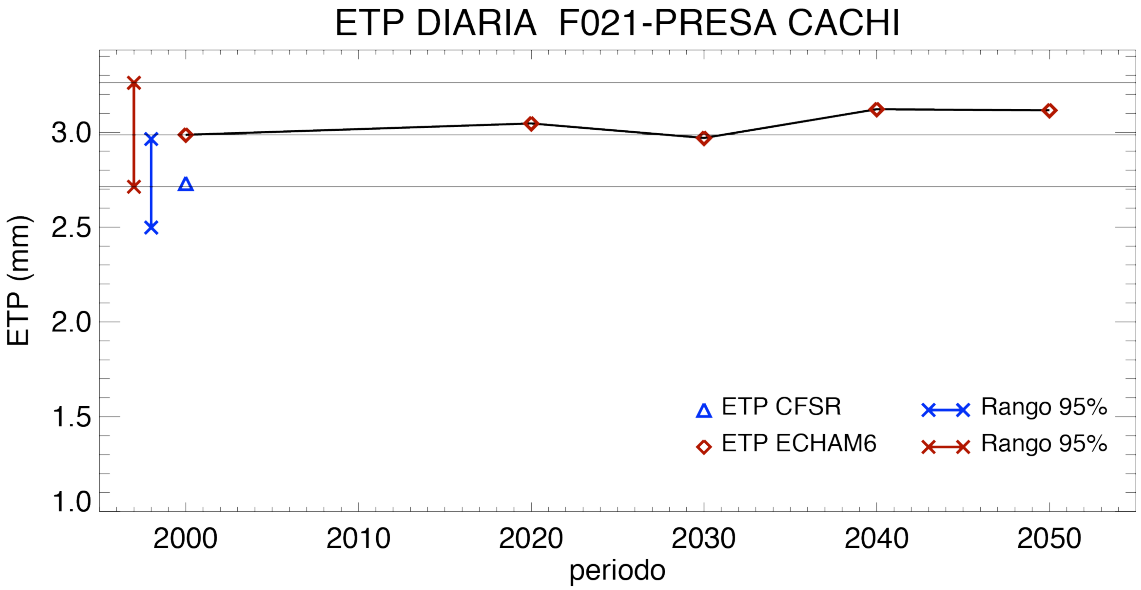

LLUVIA DIARIA 2904-SAVEGRE
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
20
25
30
2000
2010
2020
2030
2040
2050
periodo

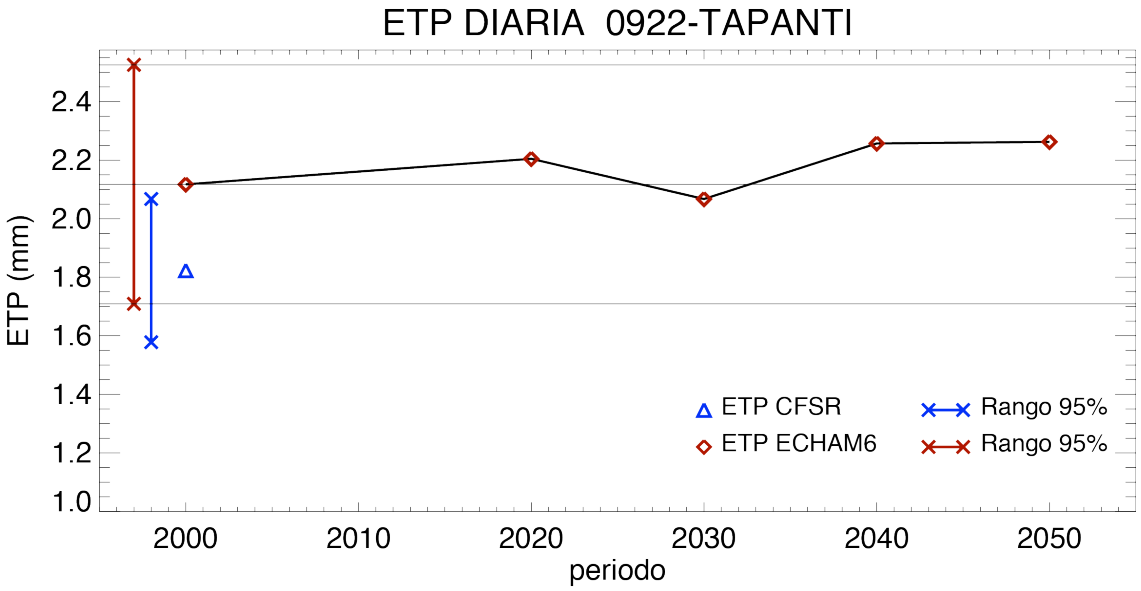

LLUVIA DIARIA 3103-EL BRUJO
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
0
5
10
15
20
25
30
2000
2010
2020
2030
2040
2050
periodo

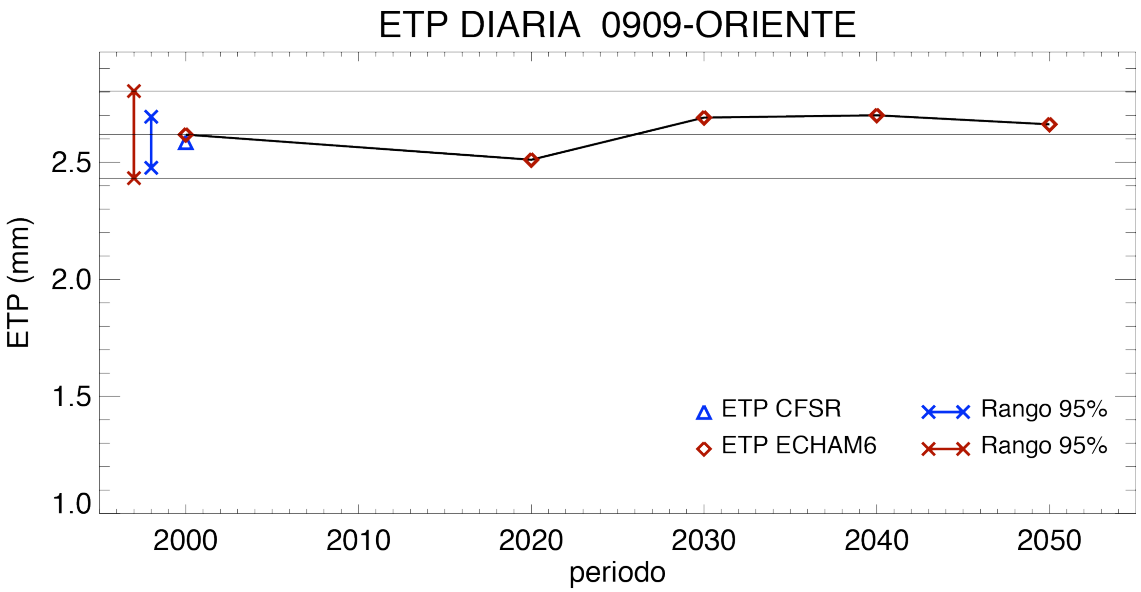

LLUVIA DIARIA 3104-REMOLINO
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
5
10
15
20
25
30
35
2000
2010
2020
2030
2040
2050

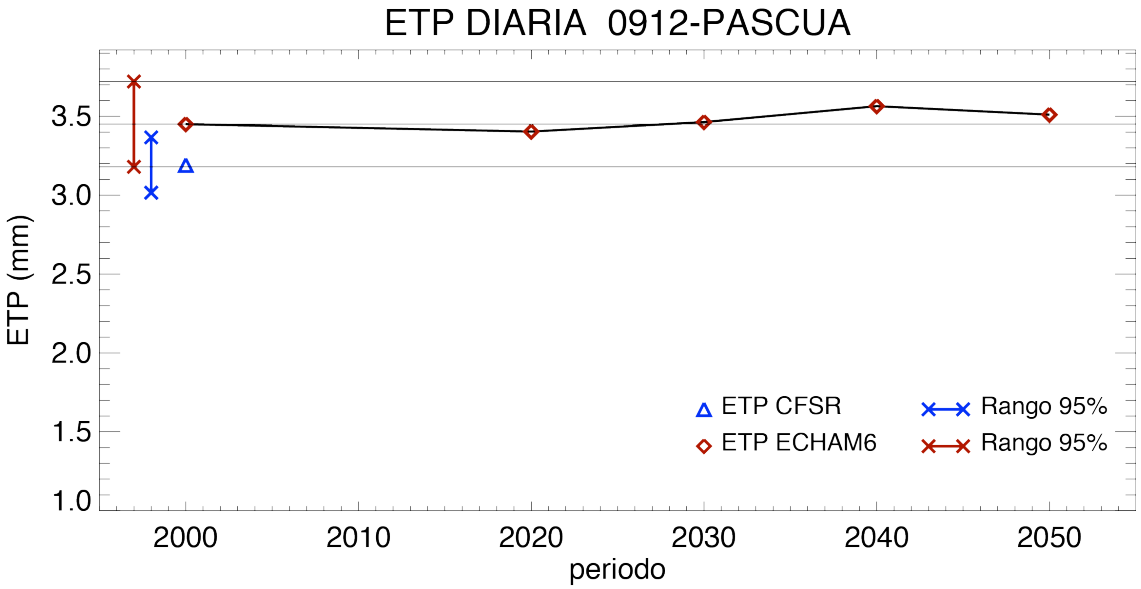

LLUVIA DIARIA 3107-CARACUCHO
ECHAM6 Seca
ECHAM6 Humeda
ECHAM6 Media
Seca Pluviografos
Humeda Pluviografos
Seca CFSR
Humeda CFSR
Seca Rango 95%
Humeda Rango 95%
P (mm)
periodo
0
5
10
15
20
2000
2010
2020
2030
2040
2050

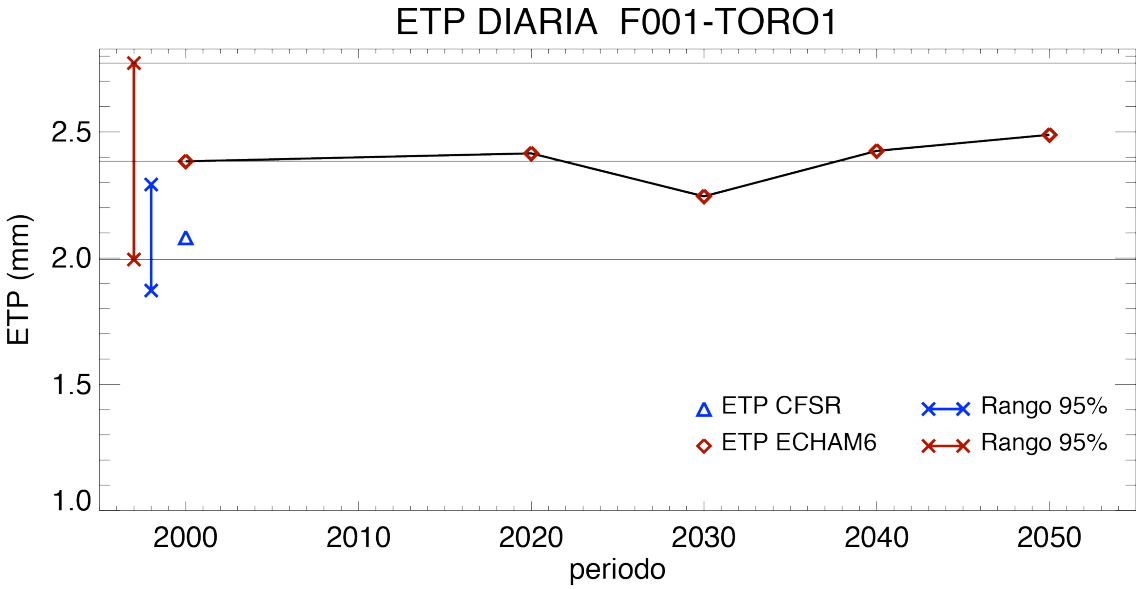
Anejo 4: Figuras de evapotranspiración potencial de cuenca

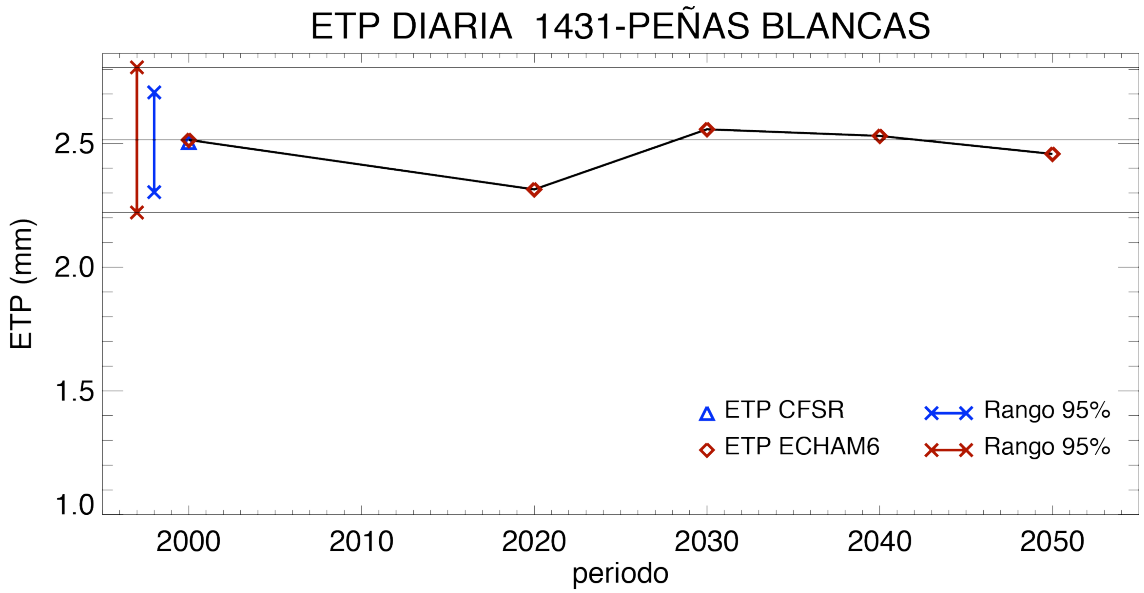


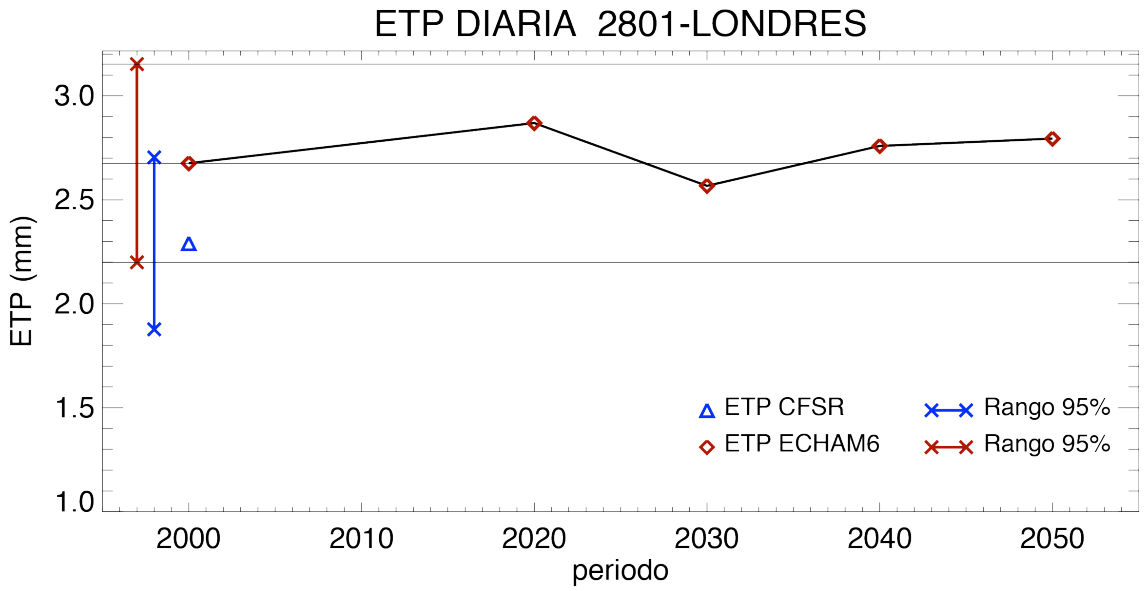


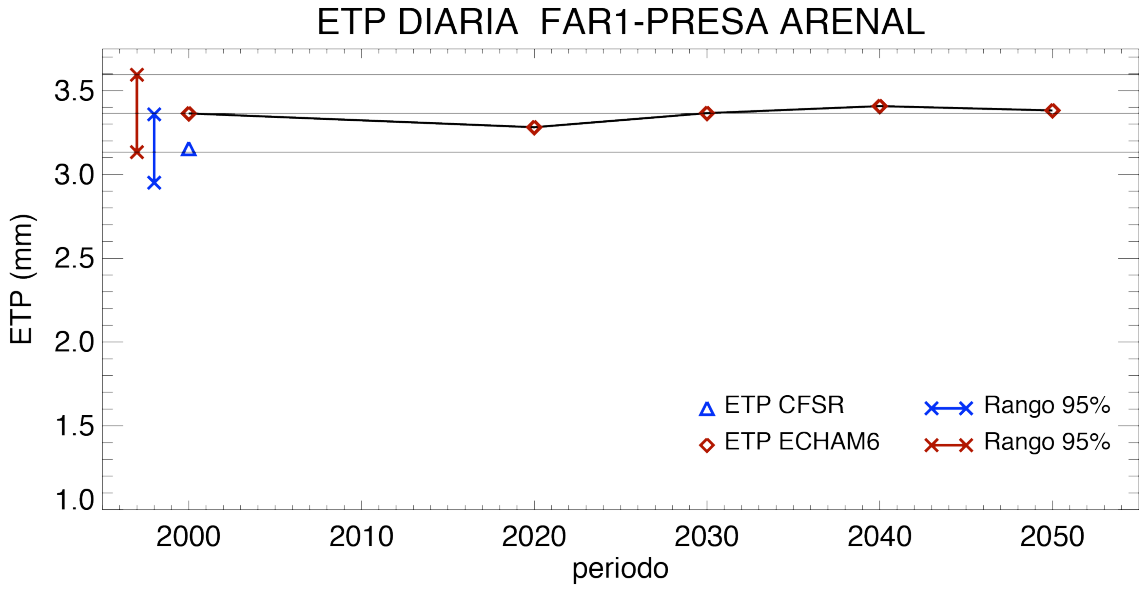

ETP DIARIA 0909-ORIENTE
ETP (mm)
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

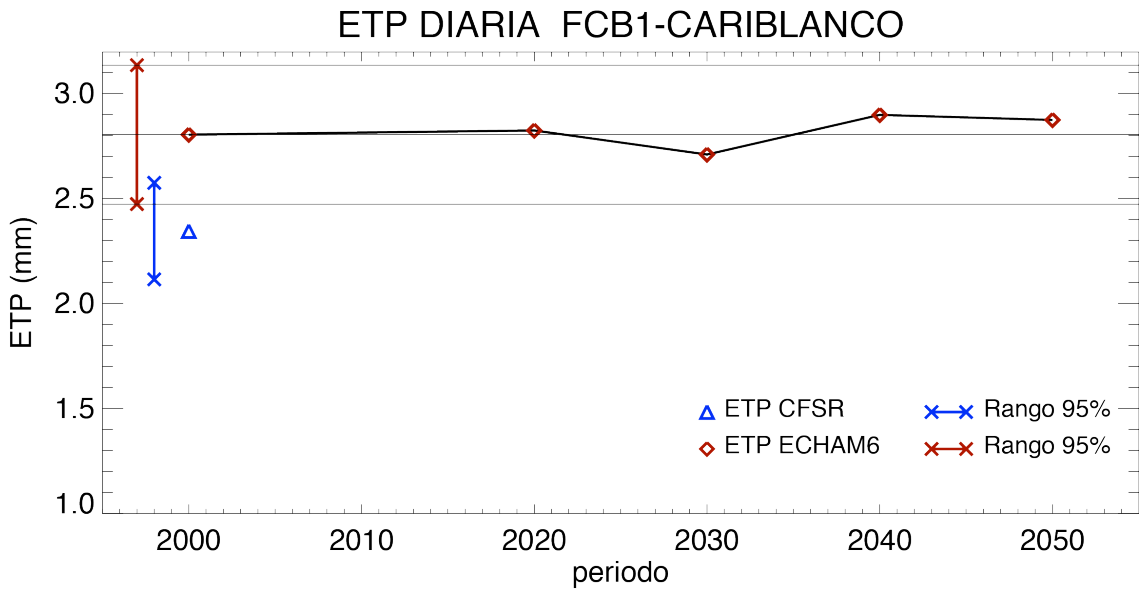

ETP DIARIA 0912-PASCUA
ETP (mm)
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

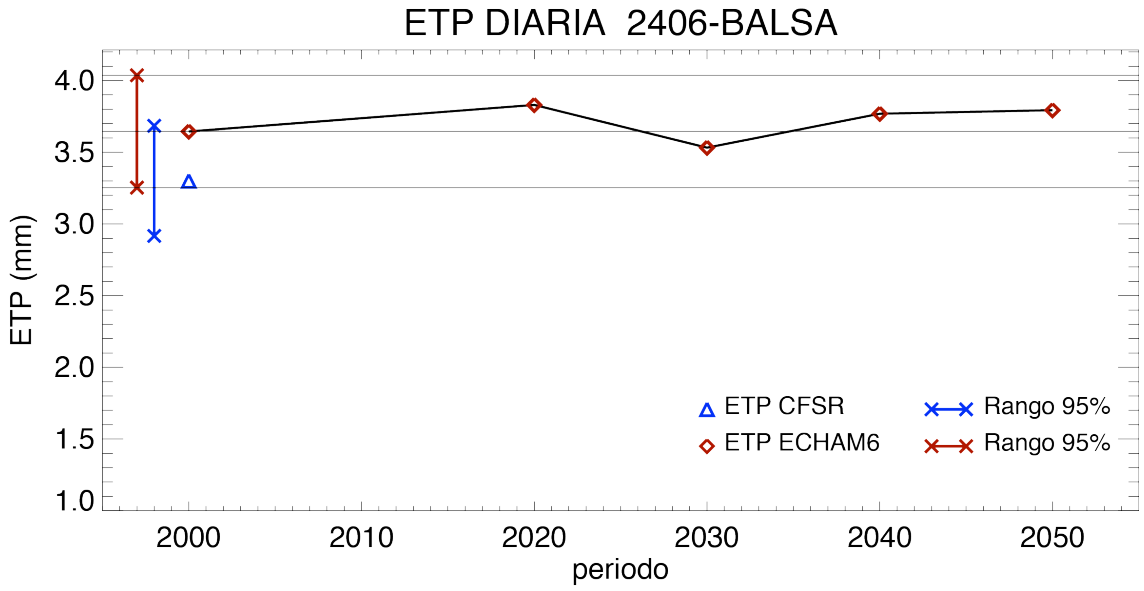

ETP DIARIA F001-TORO1
ETP (mm)
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

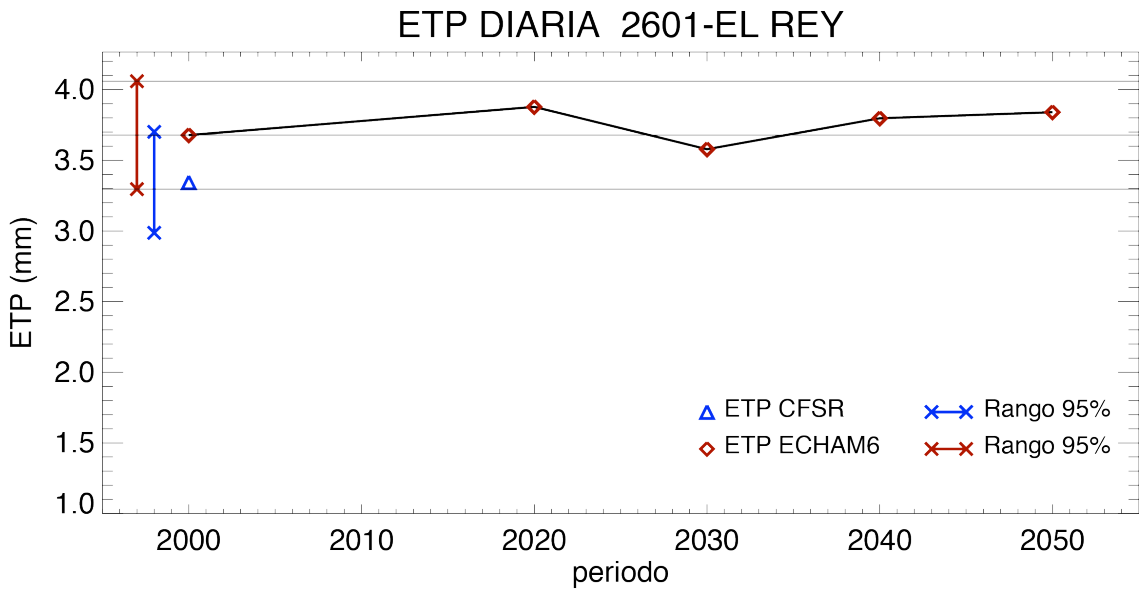

ETP DIARIA 1431-PEÑAS BLANCAS
ETP (mm)
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

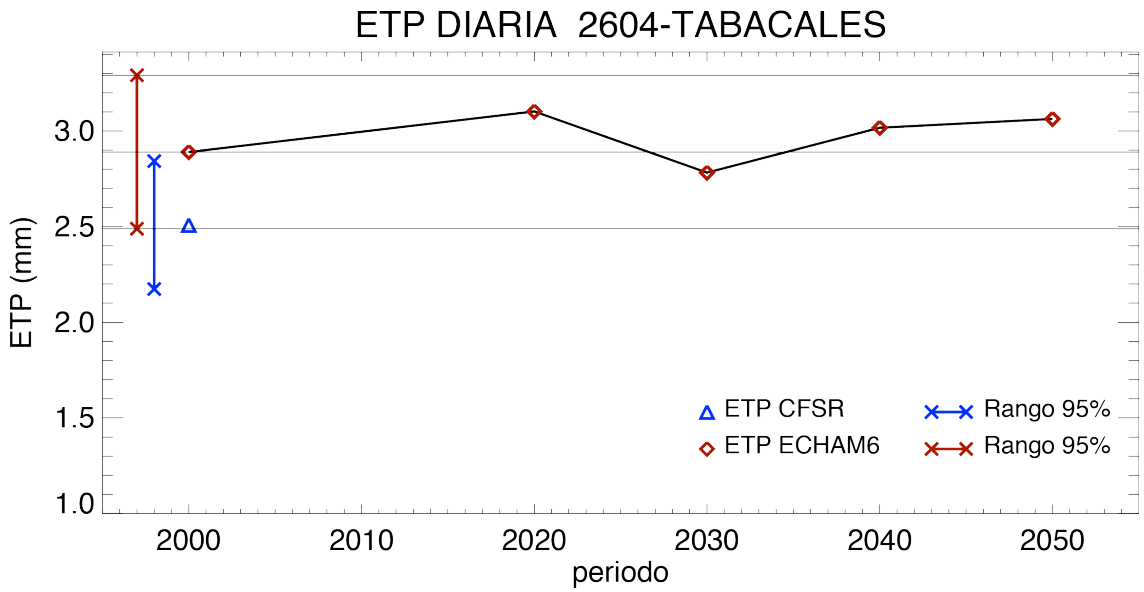

ETP DIARIA 2801-LONDRES
ETP (mm)
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

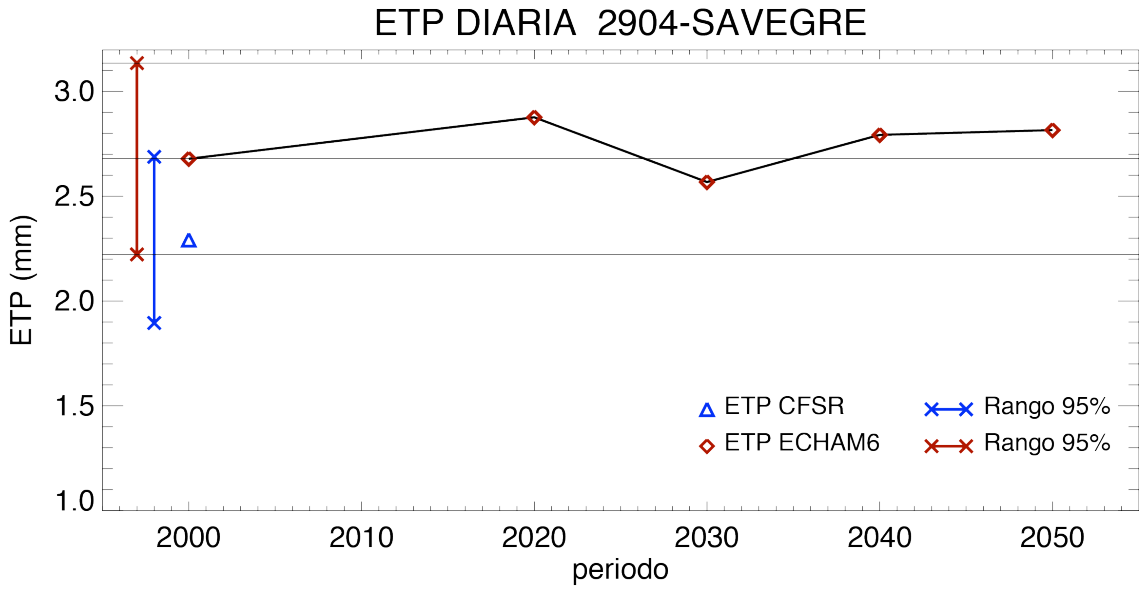

ETP DIARIA FAR1-PRESA ARENAL
ETP (mm)
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

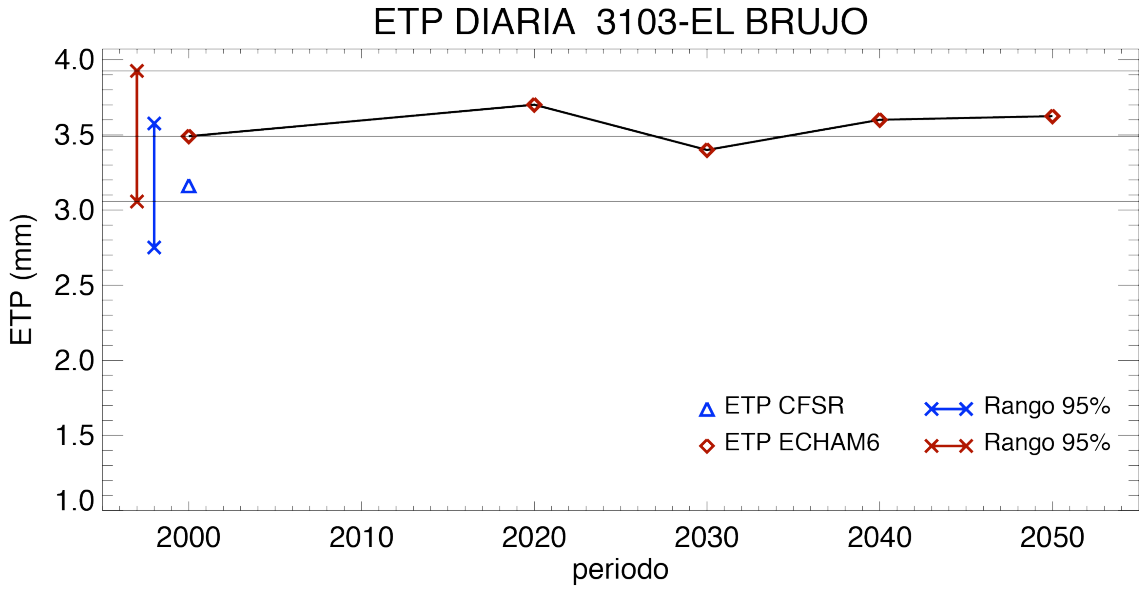

ETP DIARIA FCB1-CARIBLANCO
ETP (mm)
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
Rango 95%
ETP ECHAM6
Rango 95%

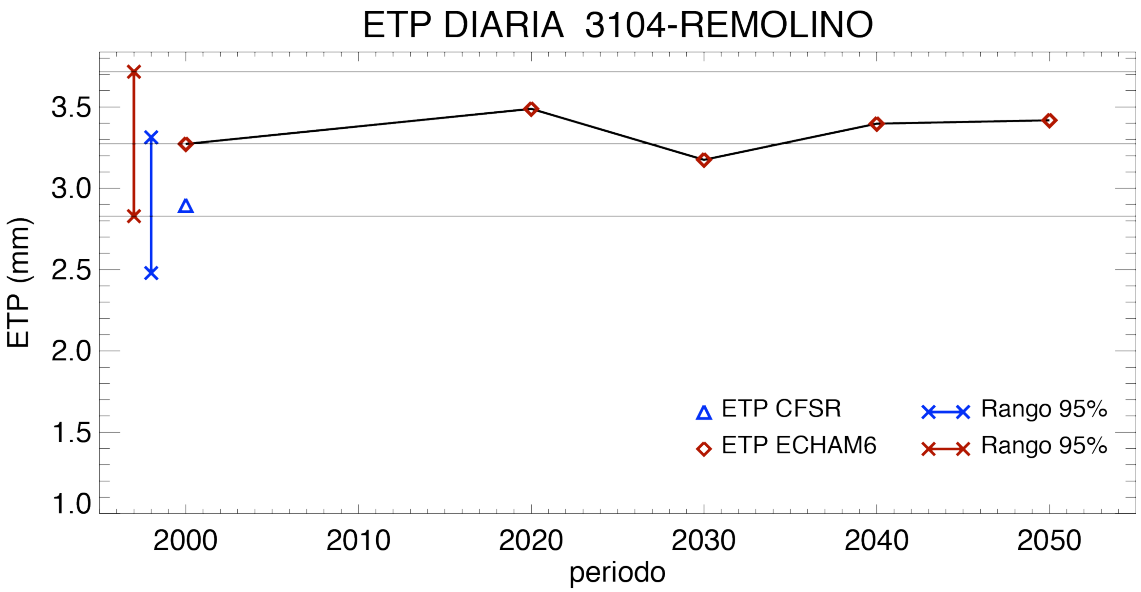

ETP DIARIA 2406-BALSA
ETP (mm)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
Rango 95%
ETP ECHAM6
Rango 95%

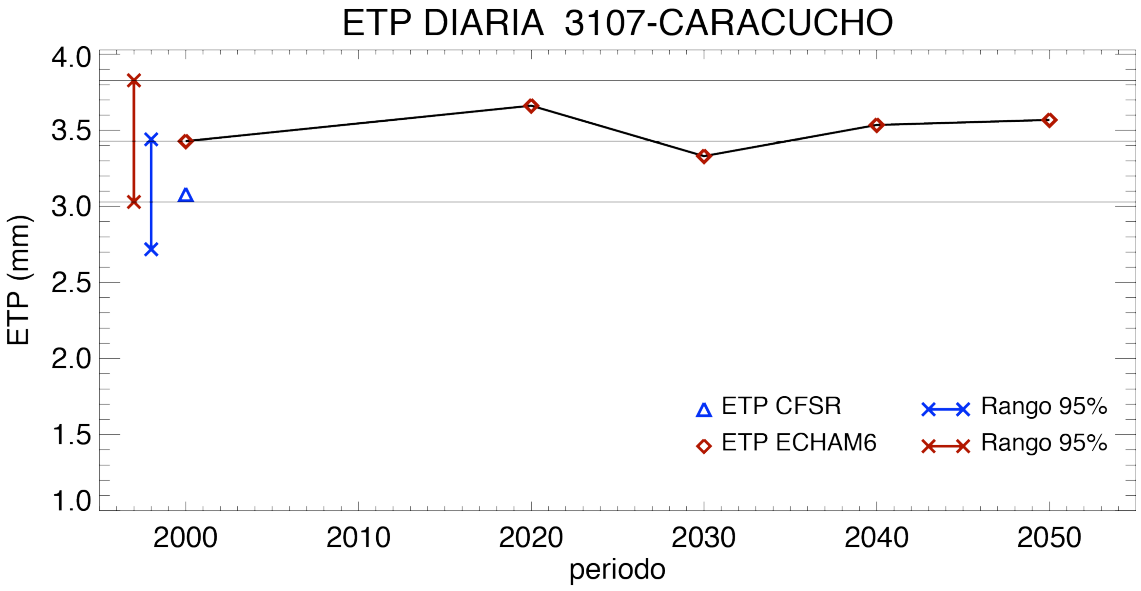

ETP DIARIA 2601-EL REY
ETP (mm)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
Rango 95%
ETP ECHAM6
Rango 95%


ETP DIARIA 2604-TABACALES
ETP (mm)
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

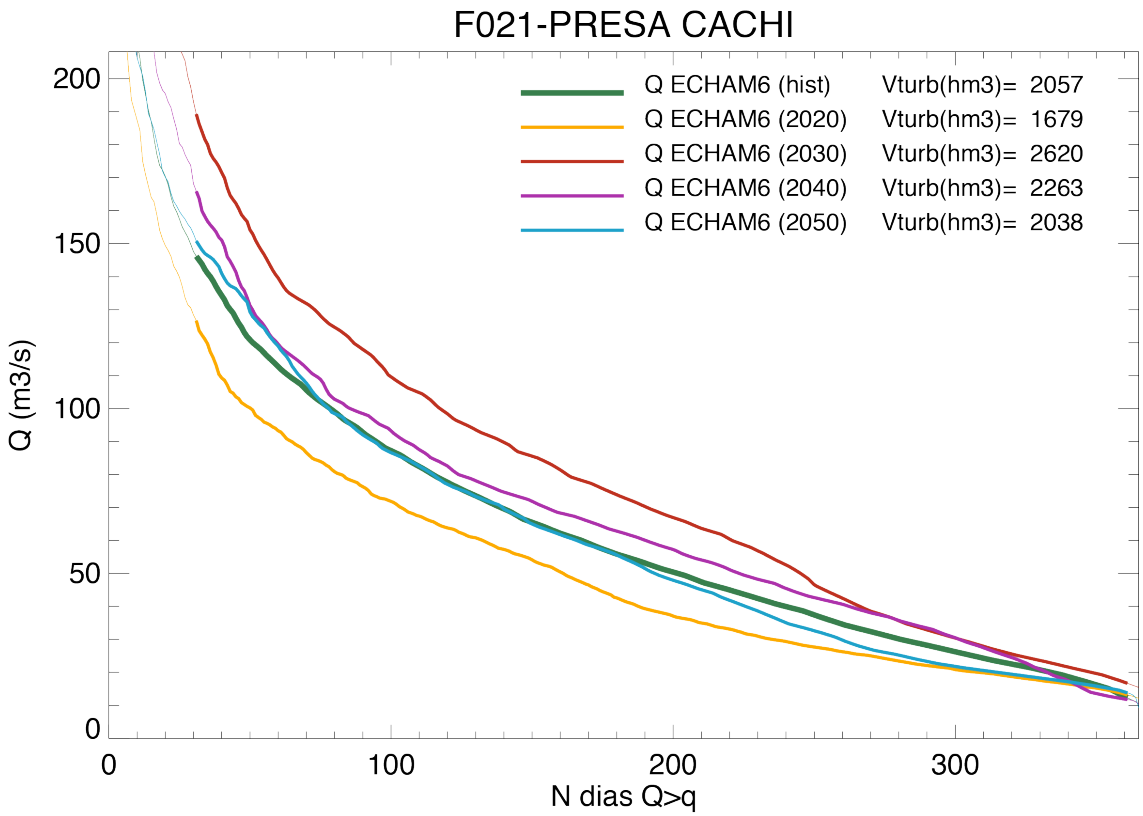

ETP DIARIA 2904-SAVEGRE
ETP (mm)
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

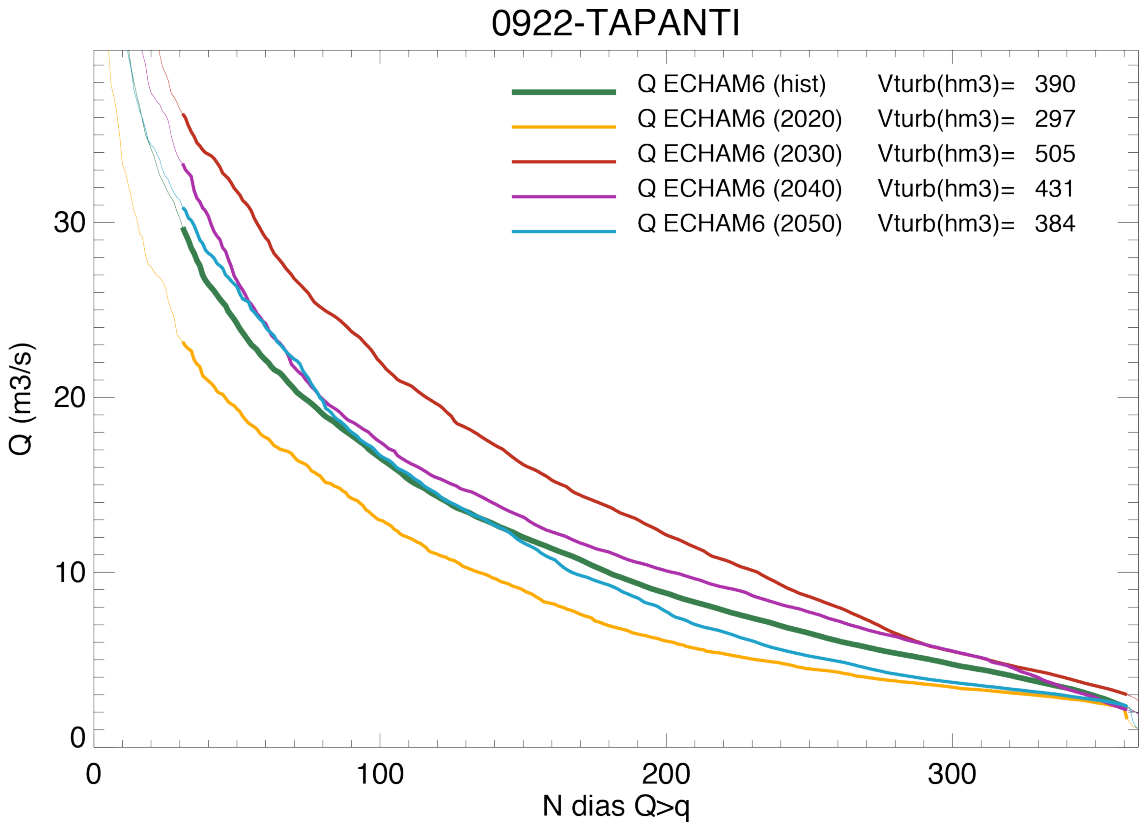

ETP DIARIA 3103-EL BRUJO
ETP (mm)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

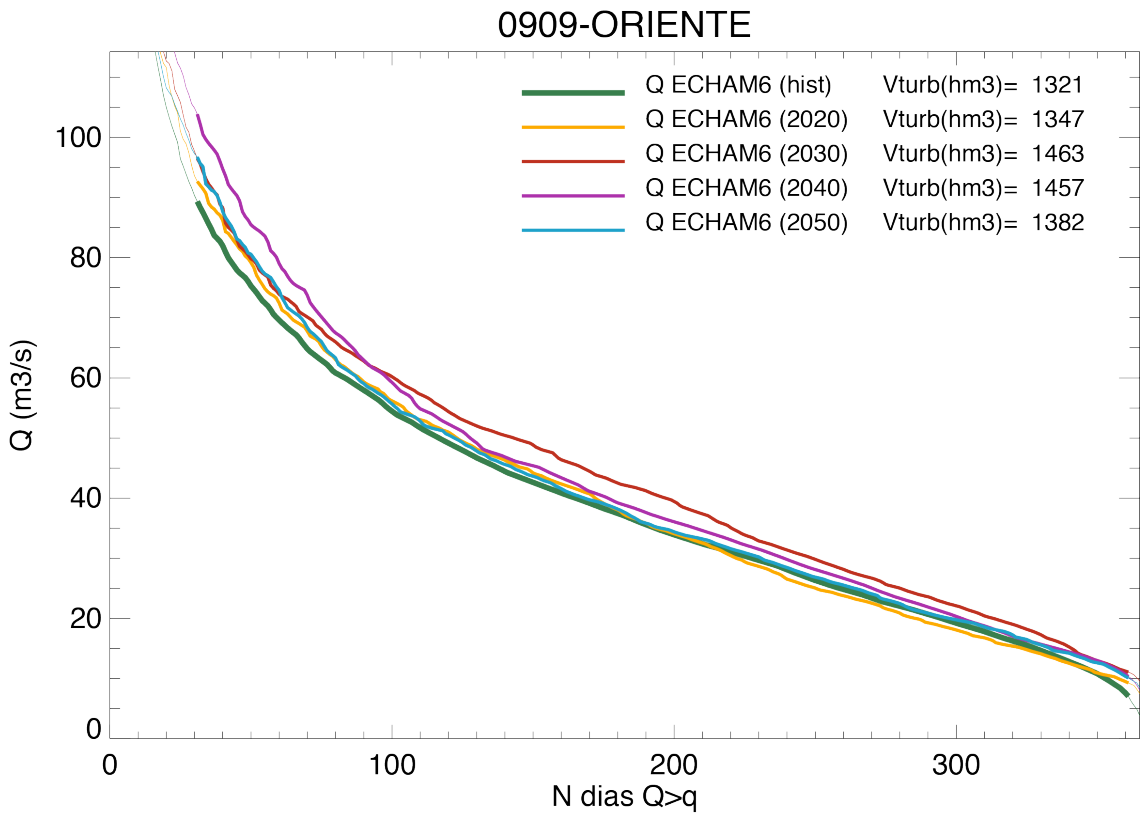

ETP DIARIA 3104-REMOLINO
ETP (mm)
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

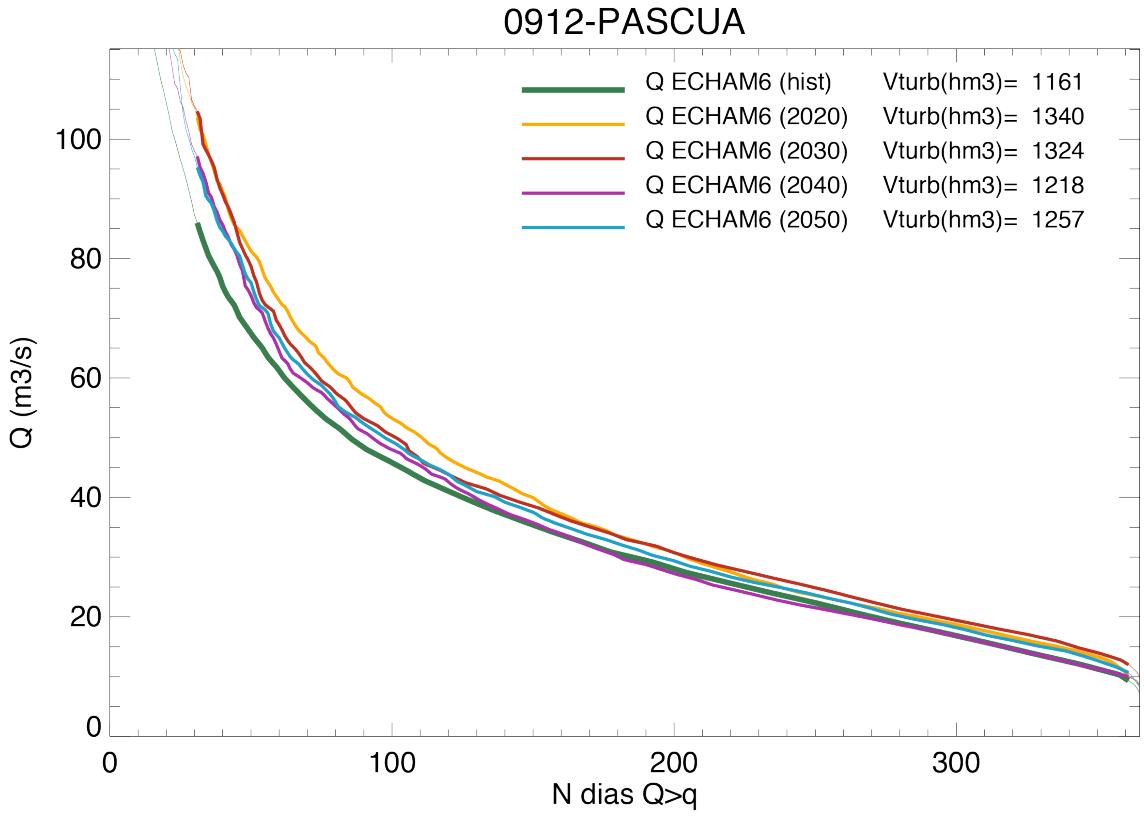

ETP DIARIA 3107-CARACUCHO
ETP (mm)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
2000
2010
2020
2030
2040
2050
periodo
ETP CFSR
ETP ECHAM6
Rango 95%
Rango 95%

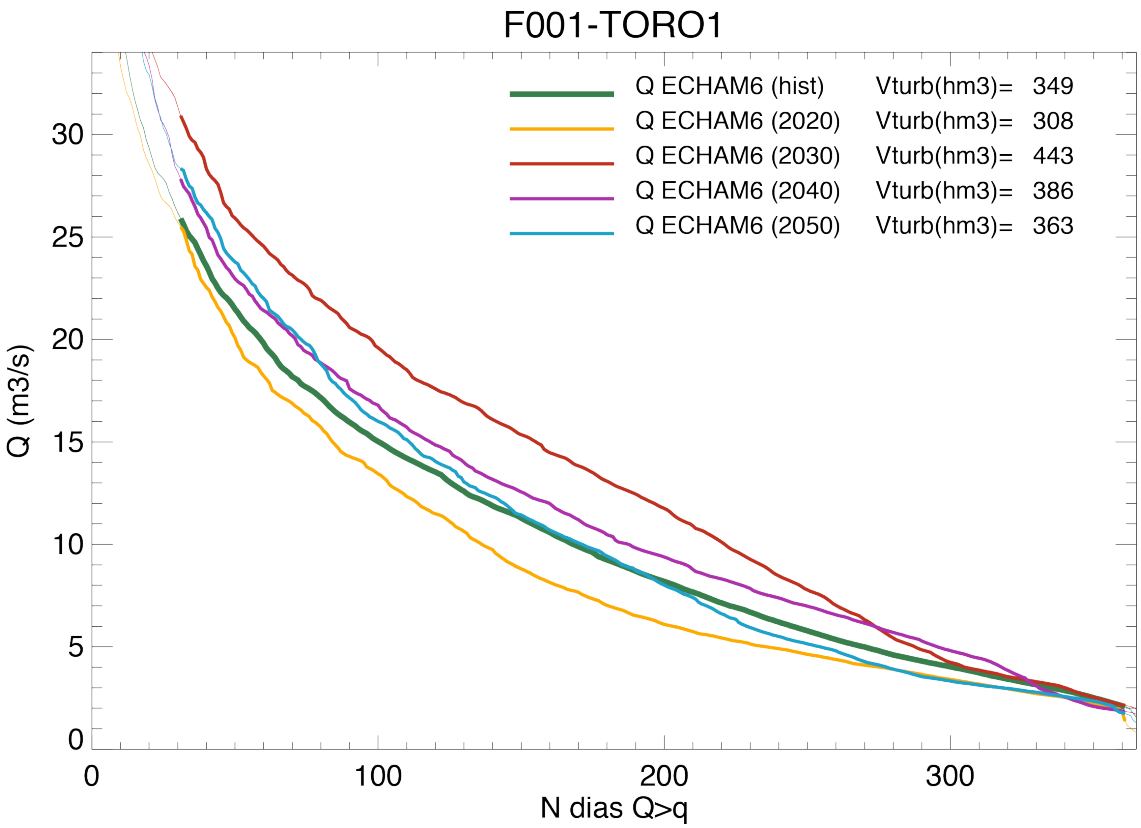
Anejo 5: Figuras de curvas de caudales clasificados para escenarios futuros

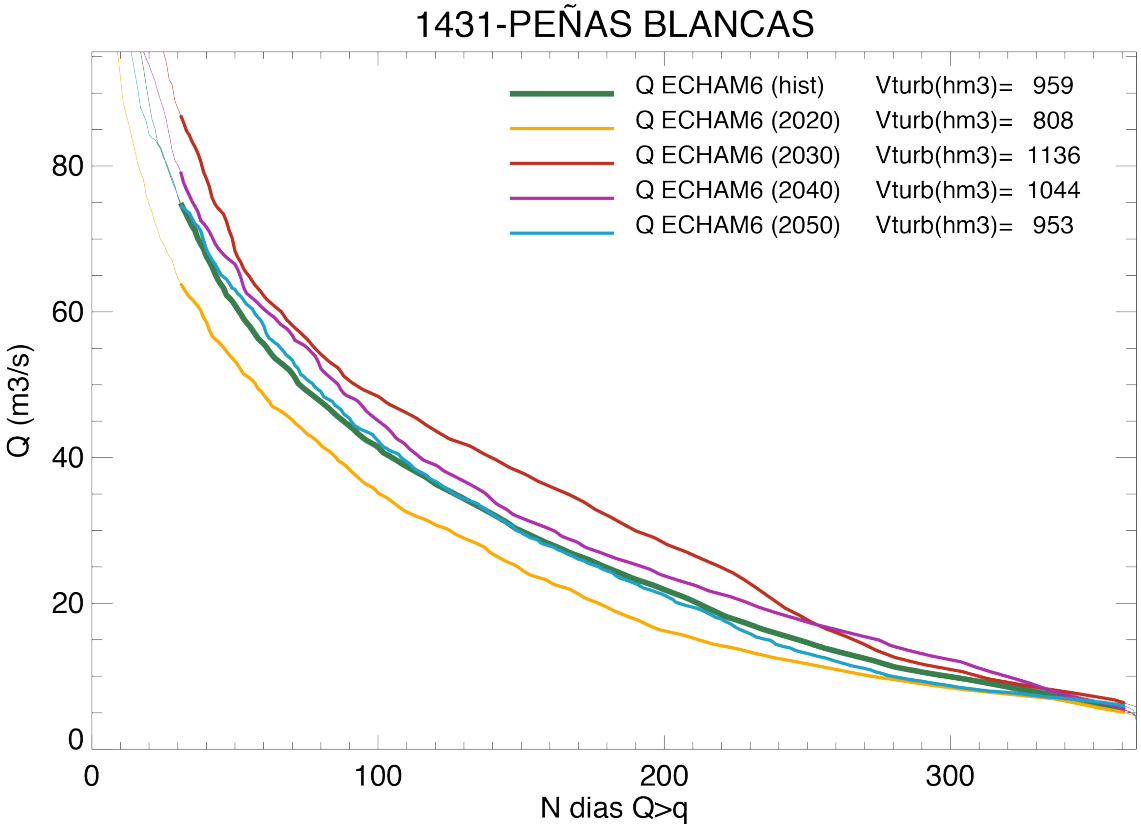


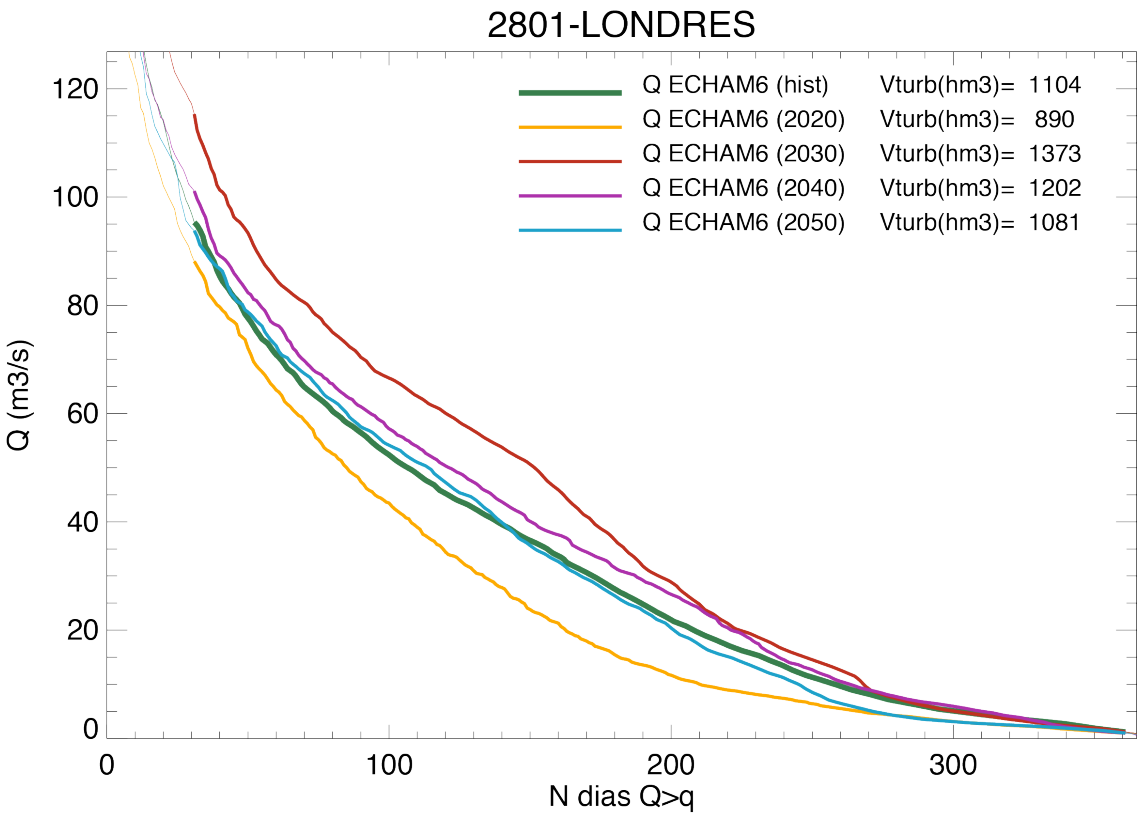


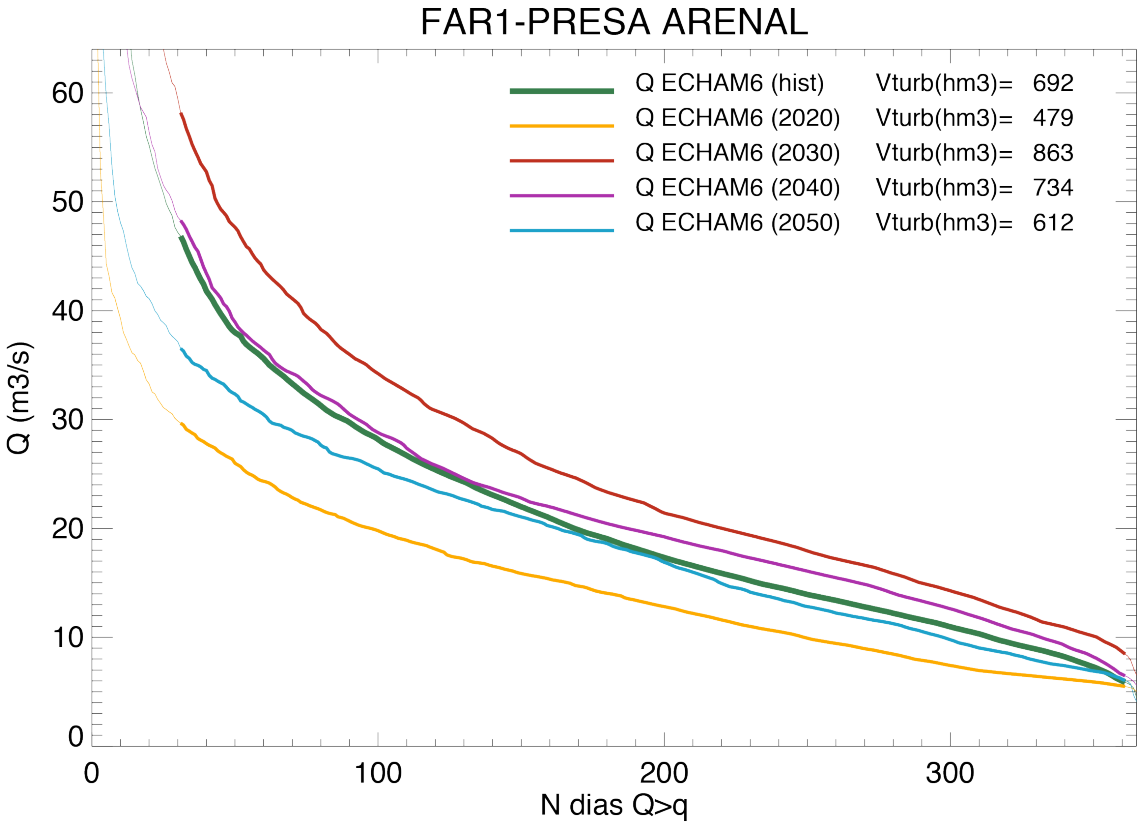

0909-ORIENTE
Q ECHAM6 (hist) Vturb(hm3)= 1321
Q ECHAM6 (2020) Vturb(hm3)= 1347
Q ECHAM6 (2030) Vturb(hm3)= 1463
Q ECHAM6 (2040) Vturb(hm3)= 1457
Q ECHAM6 (2050) Vturb(hm3)= 1382
Q (m3/s)
N dias Q>q
0
20
40
60
80
100
0
100
200
300

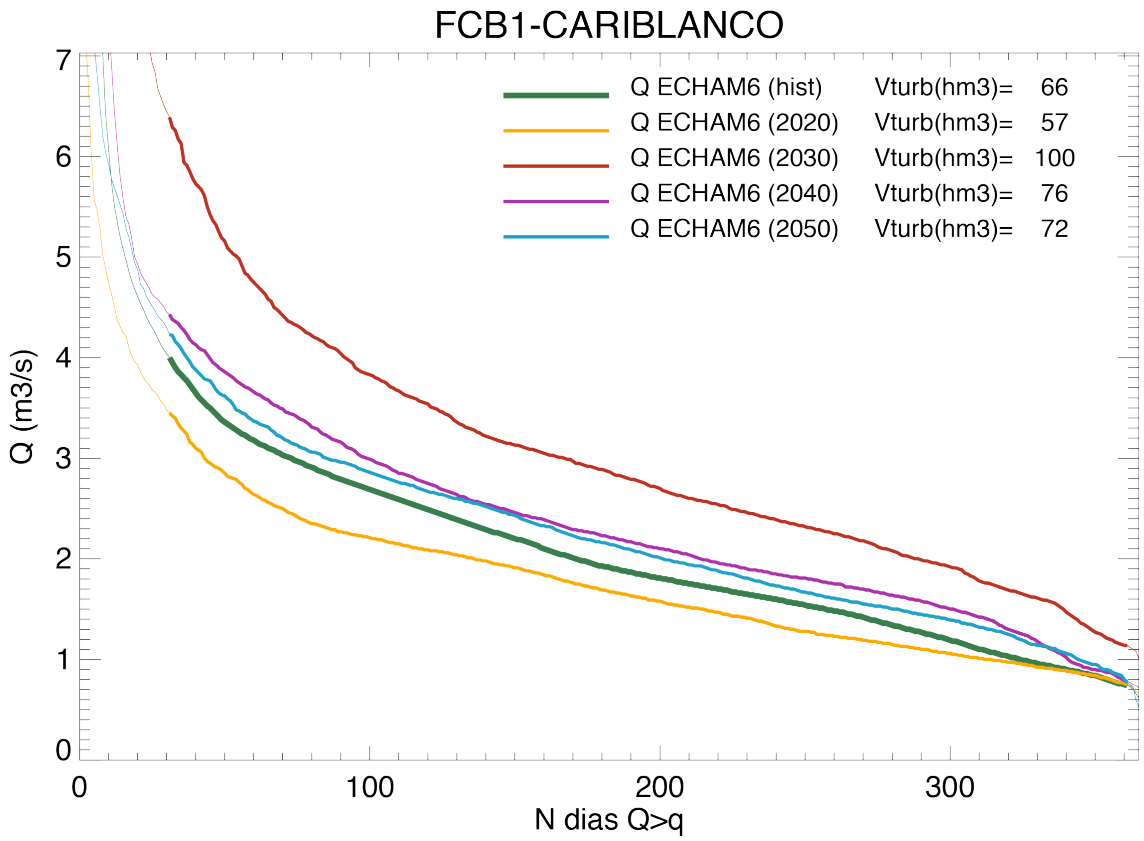

0912-PASCUA
Q ECHAM6 (hist) Vturb(hm3)= 1161
Q ECHAM6 (2020) Vturb(hm3)= 1340
Q ECHAM6 (2030) Vturb(hm3)= 1324
Q ECHAM6 (2040) Vturb(hm3)= 1218
Q ECHAM6 (2050) Vturb(hm3)= 1257
Q (m3/s)
N dias Q>q
0
20
40
60
80
100
0
100
200
300

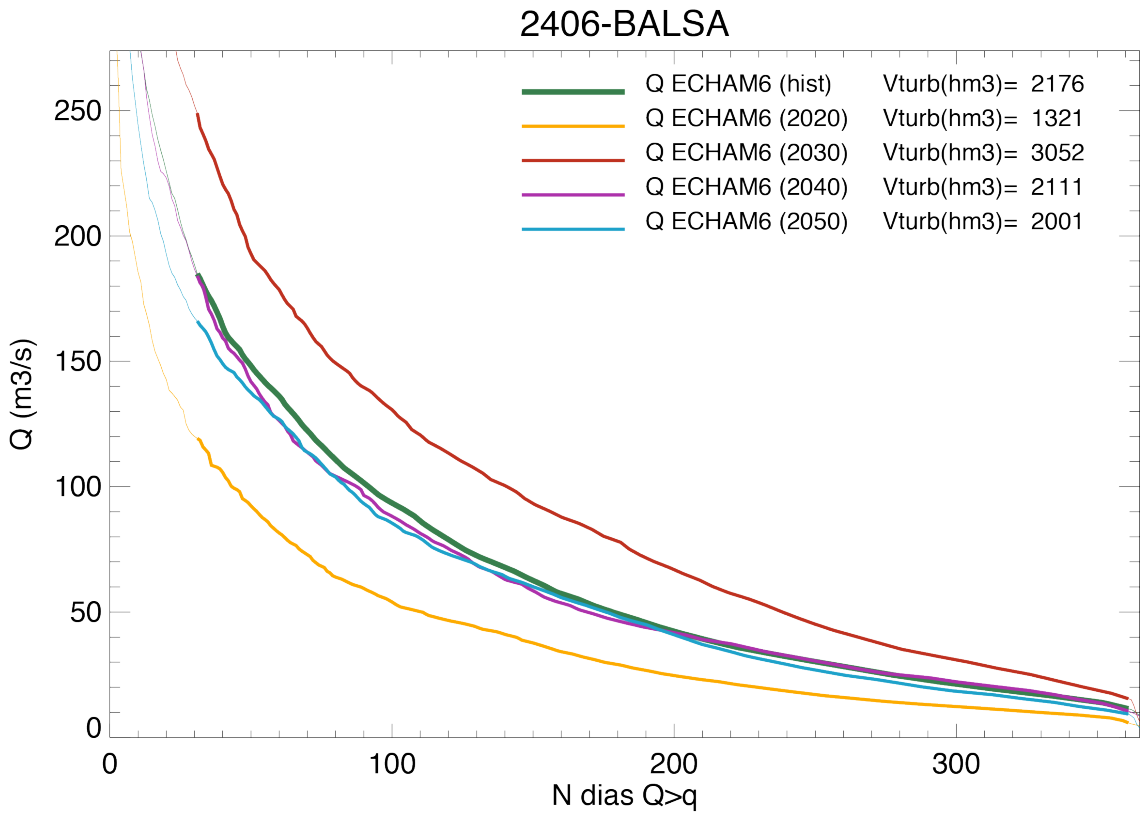

F001-TORO1
Q ECHAM6 (hist) Vturb(hm3)= 349
Q ECHAM6 (2020) Vturb(hm3)= 308
Q ECHAM6 (2030) Vturb(hm3)= 443
Q ECHAM6 (2040) Vturb(hm3)= 386
Q ECHAM6 (2050) Vturb(hm3)= 363
Q (m3/s)
N dias Q>q
0
5
10
15
20
25
30
0
100
200
300

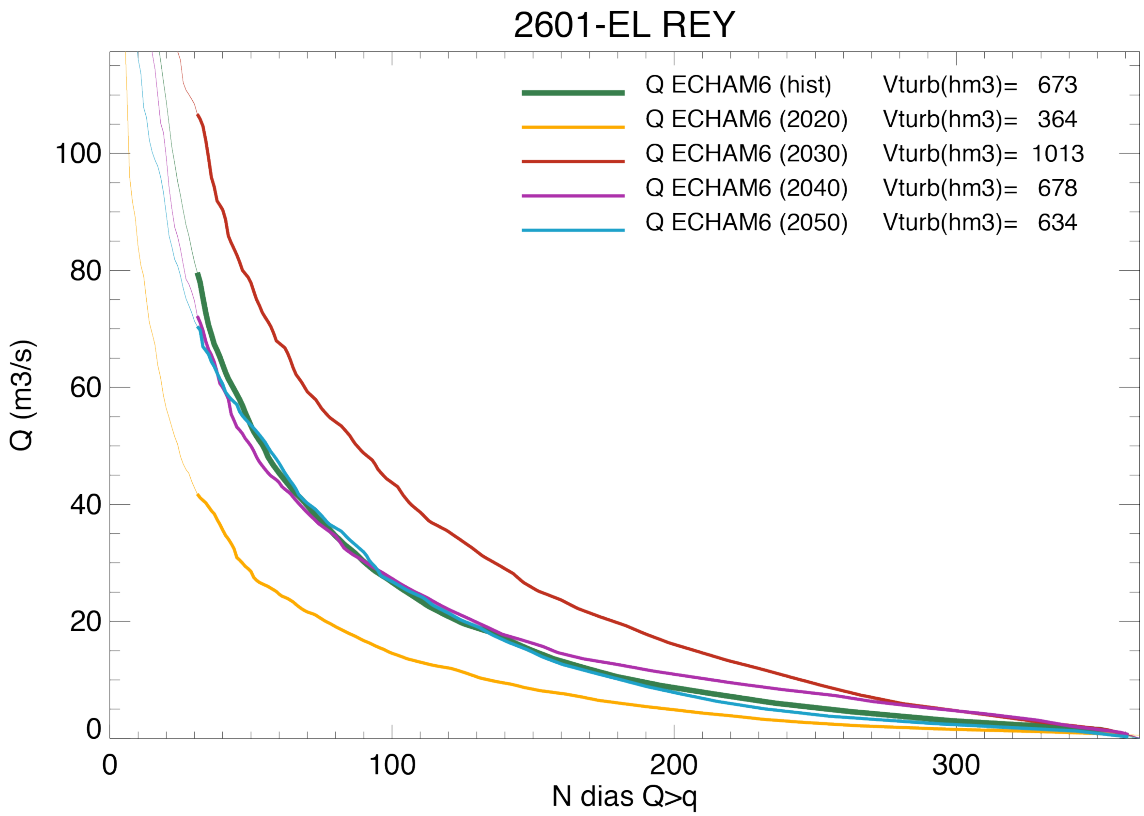

1431-PEÑAS BLANCAS
Q ECHAM6 (hist) Vturb(hm3)= 959
Q ECHAM6 (2020) Vturb(hm3)= 808
Q ECHAM6 (2030) Vturb(hm3)= 1136
Q ECHAM6 (2040) Vturb(hm3)= 1044
Q ECHAM6 (2050) Vturb(hm3)= 953
Q (m3/s)
N dias Q>q
0
20
40
60
80
0
100
200
300

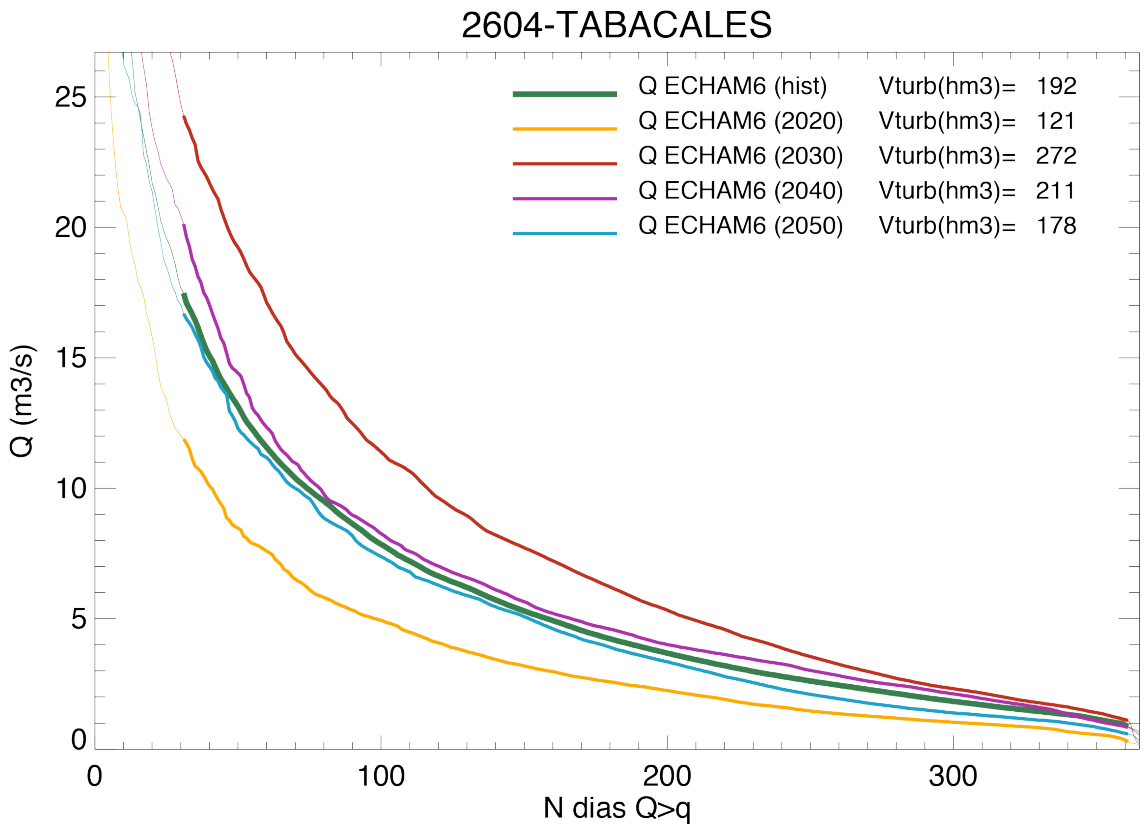

2801-LONDRES
Q ECHAM6 (hist) Vturb(hm3)= 1104
Q ECHAM6 (2020) Vturb(hm3)= 890
Q ECHAM6 (2030) Vturb(hm3)= 1373
Q ECHAM6 (2040) Vturb(hm3)= 1202
Q ECHAM6 (2050) Vturb(hm3)= 1081
Q (m3/s)
N dias Q>q
0
20
40
60
80
100
120
0
100
200
300

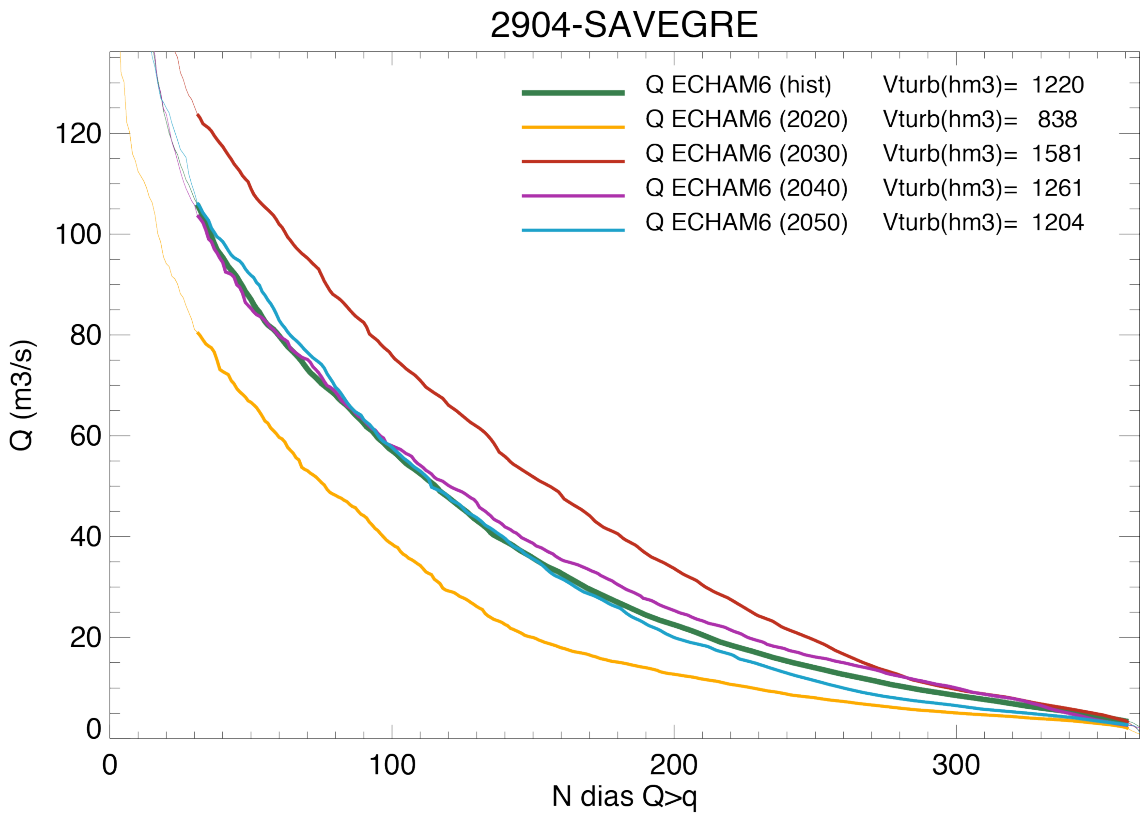

FAR1-PRESA ARENAL
Q ECHAM6 (hist) Vturb(hm3)= 692
Q ECHAM6 (2020) Vturb(hm3)= 479
Q ECHAM6 (2030) Vturb(hm3)= 863
Q ECHAM6 (2040) Vturb(hm3)= 734
Q ECHAM6 (2050) Vturb(hm3)= 612
Q (m3/s)
N dias Q>q
0
10
20
30
40
50
60
0
100
200
300

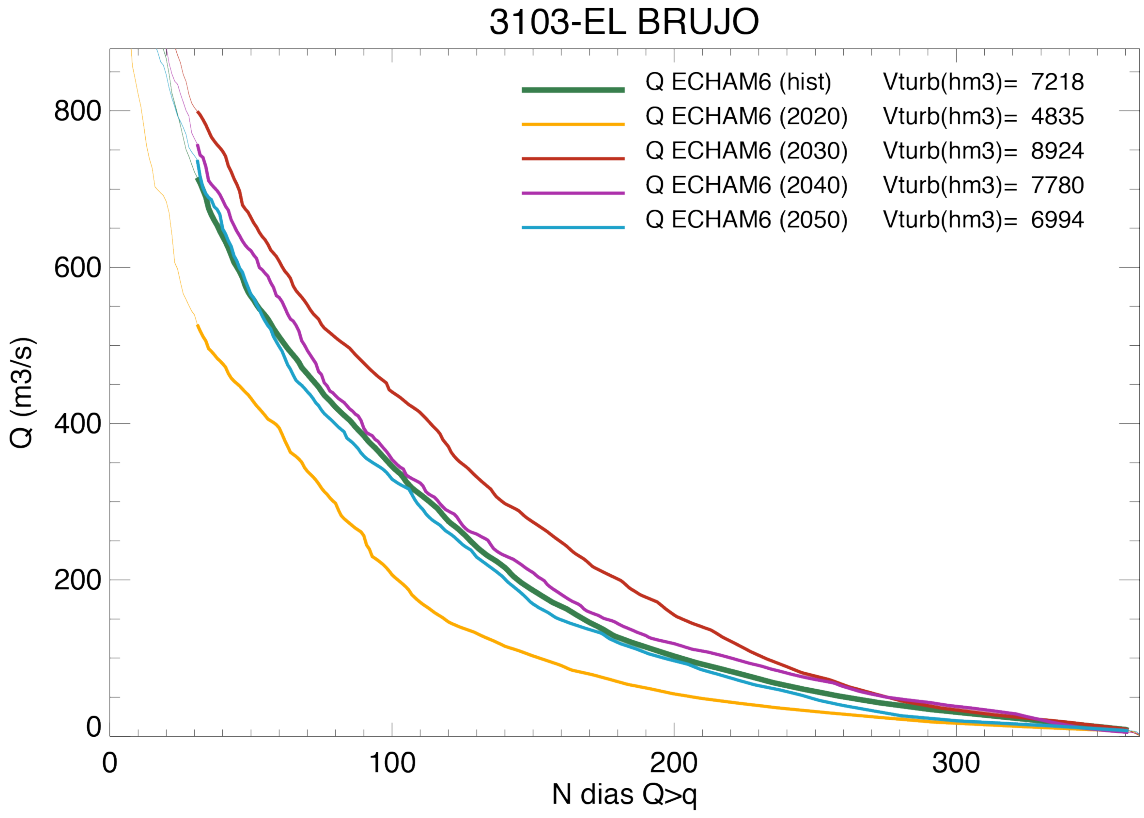

FCB1-CARIBLANCO
Q ECHAM6 (hist) Vturb(hm3)= 66
Q ECHAM6 (2020) Vturb(hm3)= 57
Q ECHAM6 (2030) Vturb(hm3)= 100
Q ECHAM6 (2040) Vturb(hm3)= 76
Q ECHAM6 (2050) Vturb(hm3)= 72
Q (m3/s)
N dias Q>q
0
1
2
3
4
5
6
7
0
100
200
300

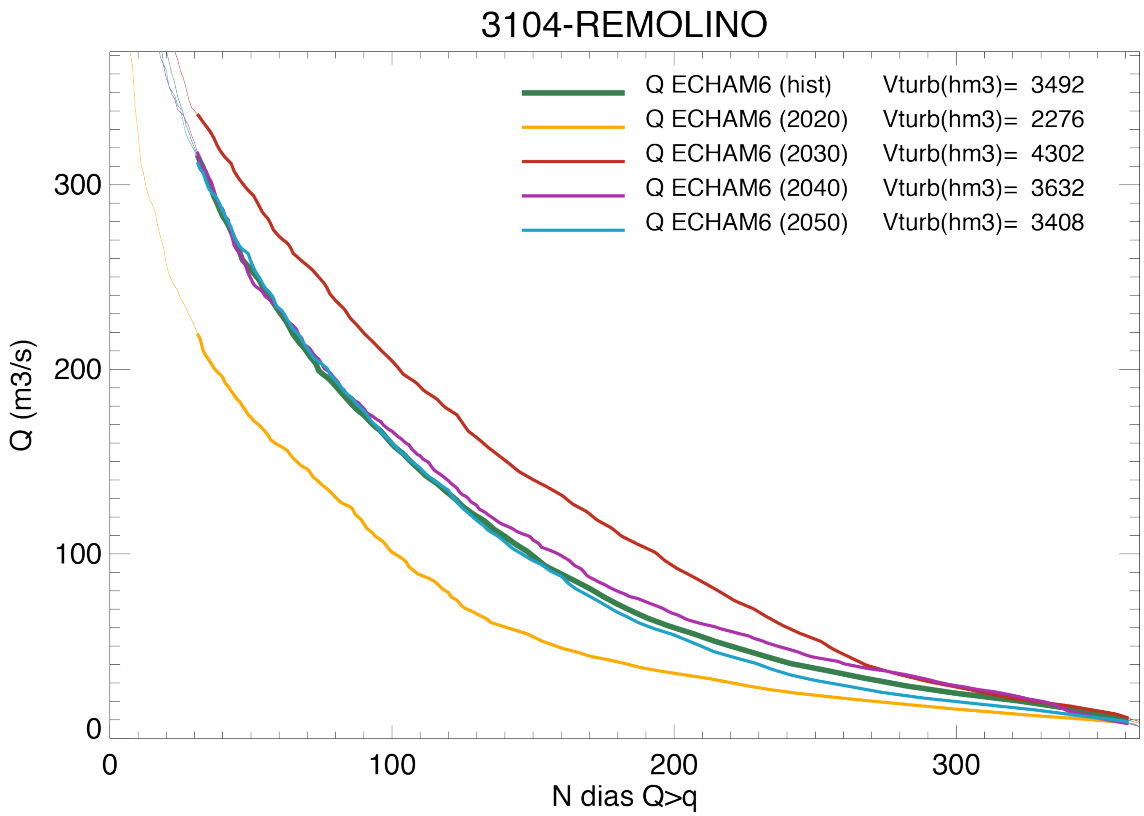

2406-BALSA
Q ECHAM6 (hist) Vturb(hm3)= 2176
Q ECHAM6 (2020) Vturb(hm3)= 1321
Q ECHAM6 (2030) Vturb(hm3)= 3052
Q ECHAM6 (2040) Vturb(hm3)= 2111
Q ECHAM6 (2050) Vturb(hm3)= 2001
Q (m3/s)
N dias Q>q
0
50
100
150
200
250
0
100
200
300

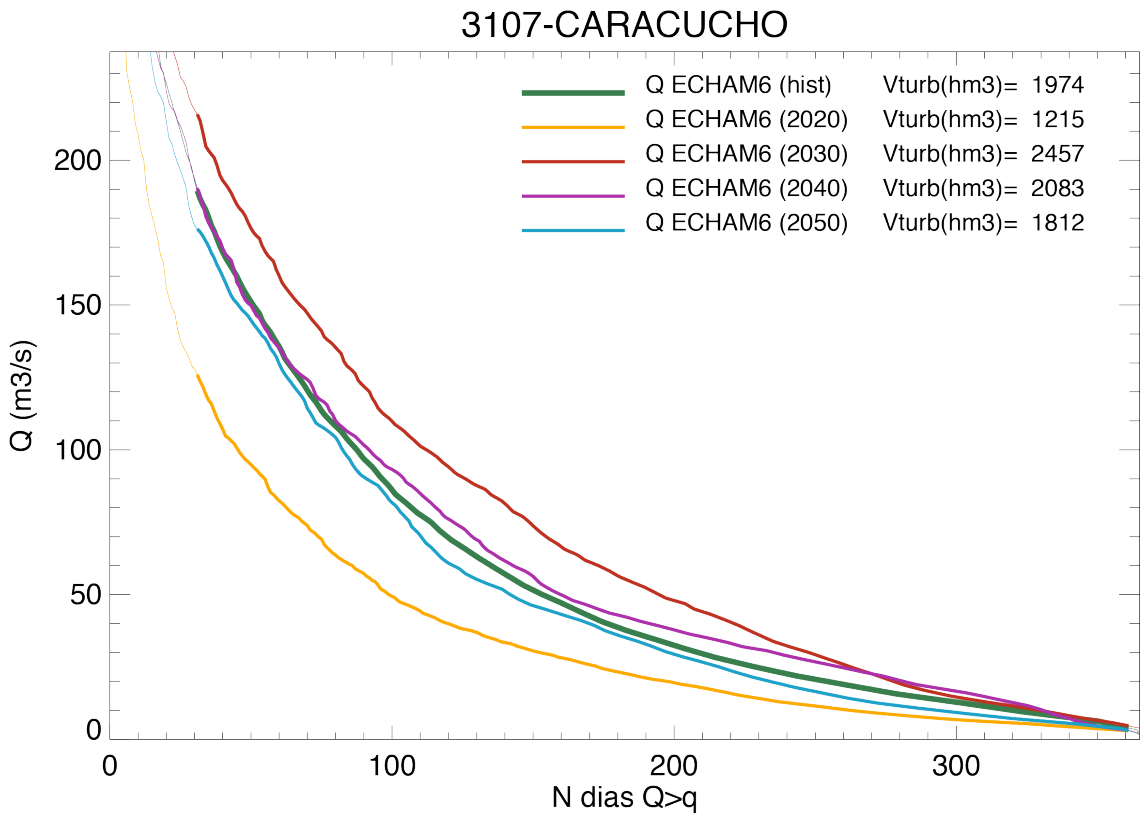

2601-EL REY
Q ECHAM6 (hist) Vturb(hm3)= 673
Q ECHAM6 (2020) Vturb(hm3)= 364
Q ECHAM6 (2030) Vturb(hm3)= 1013
Q ECHAM6 (2040) Vturb(hm3)= 678
Q ECHAM6 (2050) Vturb(hm3)= 634
Q (m3/s)
N dias Q>q
0
20
40
60
80
100
0
100
200
300


2604-TABACALES
Q ECHAM6 (hist) Vturb(hm3)= 192
Q ECHAM6 (2020) Vturb(hm3)= 121
Q ECHAM6 (2030) Vturb(hm3)= 272
Q ECHAM6 (2040) Vturb(hm3)= 211
Q ECHAM6 (2050) Vturb(hm3)= 178
Q (m3/s)
N dias Q>q
0
5
10
15
20
25
0
100
200
300

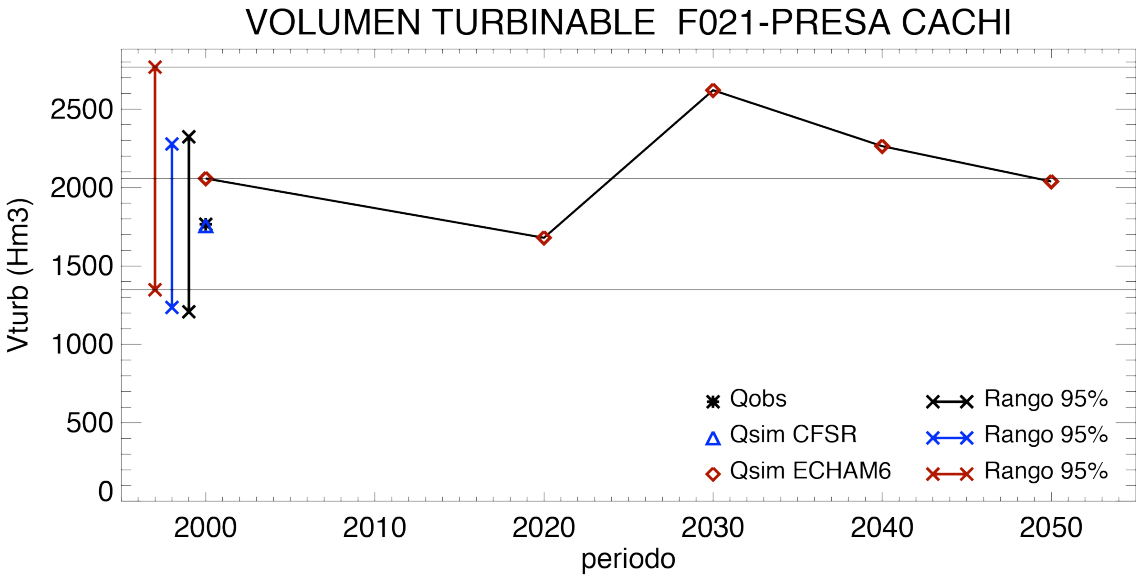

2904-SAVEGRE
Q ECHAM6 (hist) Vturb(hm3)= 1220
Q ECHAM6 (2020) Vturb(hm3)= 838
Q ECHAM6 (2030) Vturb(hm3)= 1581
Q ECHAM6 (2040) Vturb(hm3)= 1261
Q ECHAM6 (2050) Vturb(hm3)= 1204
Q (m3/s)
N dias Q>q
0
20
40
60
80
100
120
0
100
200
300

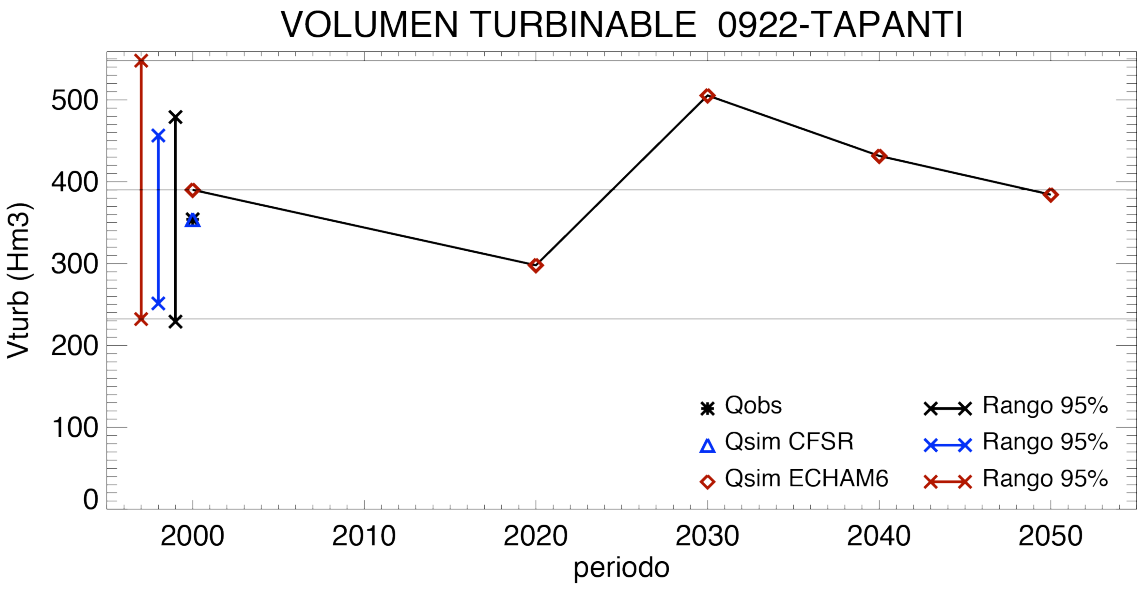

3103-EL BRUJO
Q ECHAM6 (hist) Vturb(hm3)= 7218
Q ECHAM6 (2020) Vturb(hm3)= 4835
Q ECHAM6 (2030) Vturb(hm3)= 8924
Q ECHAM6 (2040) Vturb(hm3)= 7780
Q ECHAM6 (2050) Vturb(hm3)= 6994
Q (m3/s)
N dias Q>q
0
200
400
600
800
0
100
200
300

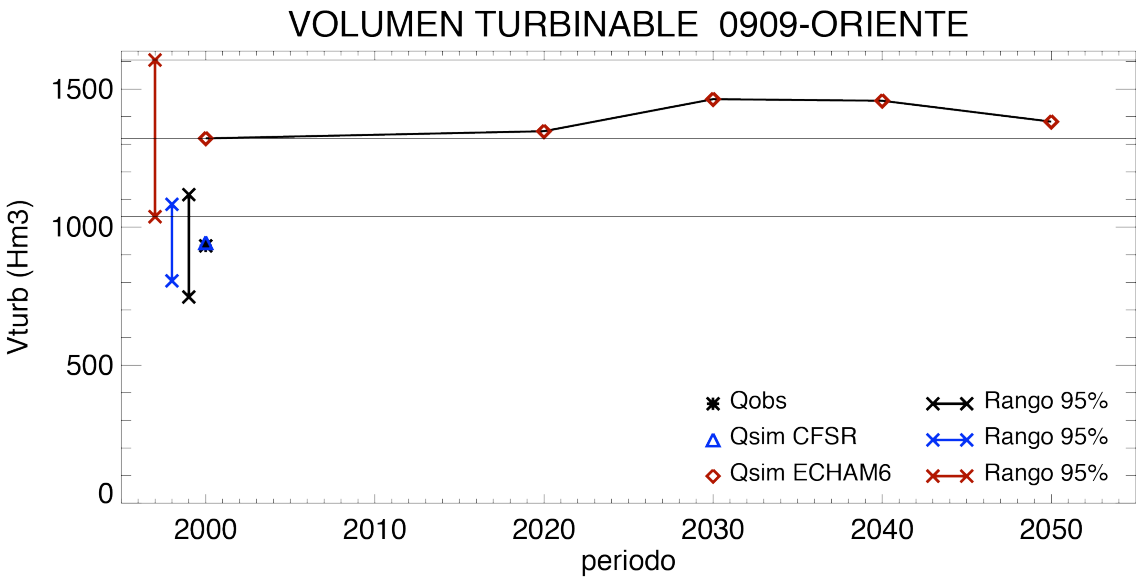

3104-REMOLINO
Q ECHAM6 (hist) Vturb(hm3)= 3492
Q ECHAM6 (2020) Vturb(hm3)= 2276
Q ECHAM6 (2030) Vturb(hm3)= 4302
Q ECHAM6 (2040) Vturb(hm3)= 3632
Q ECHAM6 (2050) Vturb(hm3)= 3408
Q (m3/s)
0
100
200
300
0
100
200
300
N dias Q>q

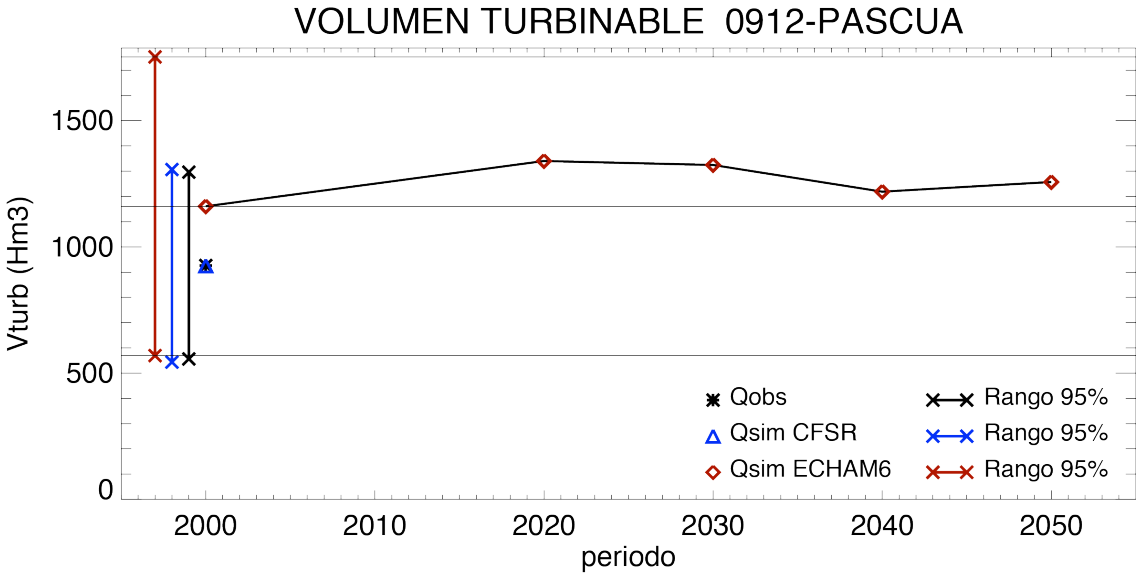

3107-CARACUCHO
Q ECHAM6 (hist) Vturb(hm3)= 1974
Q ECHAM6 (2020) Vturb(hm3)= 1215
Q ECHAM6 (2030) Vturb(hm3)= 2457
Q ECHAM6 (2040) Vturb(hm3)= 2083
Q ECHAM6 (2050) Vturb(hm3)= 1812
Q (m3/s)
0
50
100
150
200
0
100
200
300
N dias Q>q

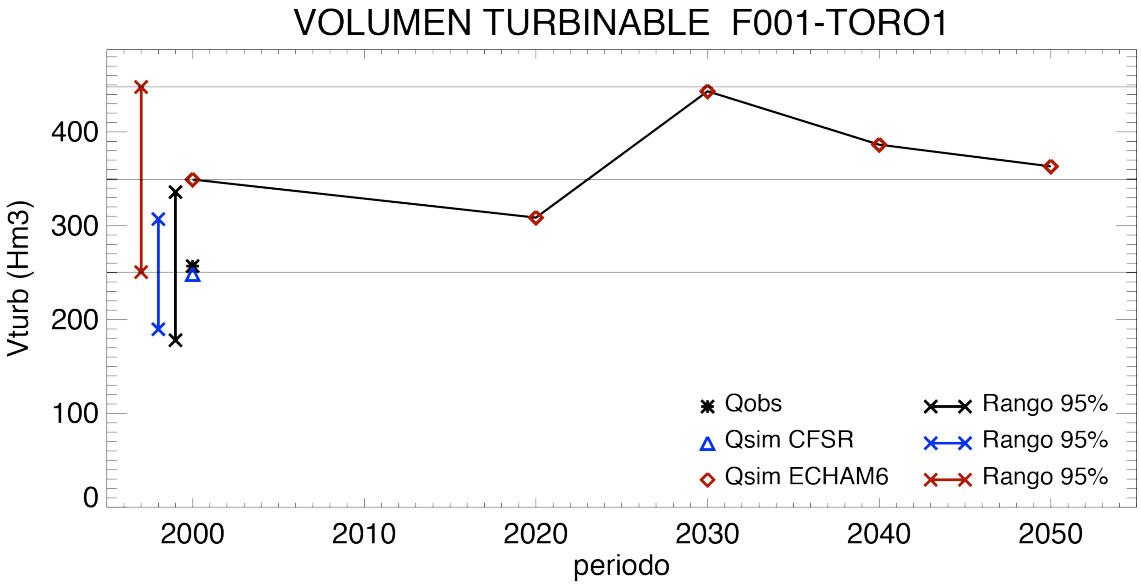
Anejo 6: Figuras de volumen turbinable anual

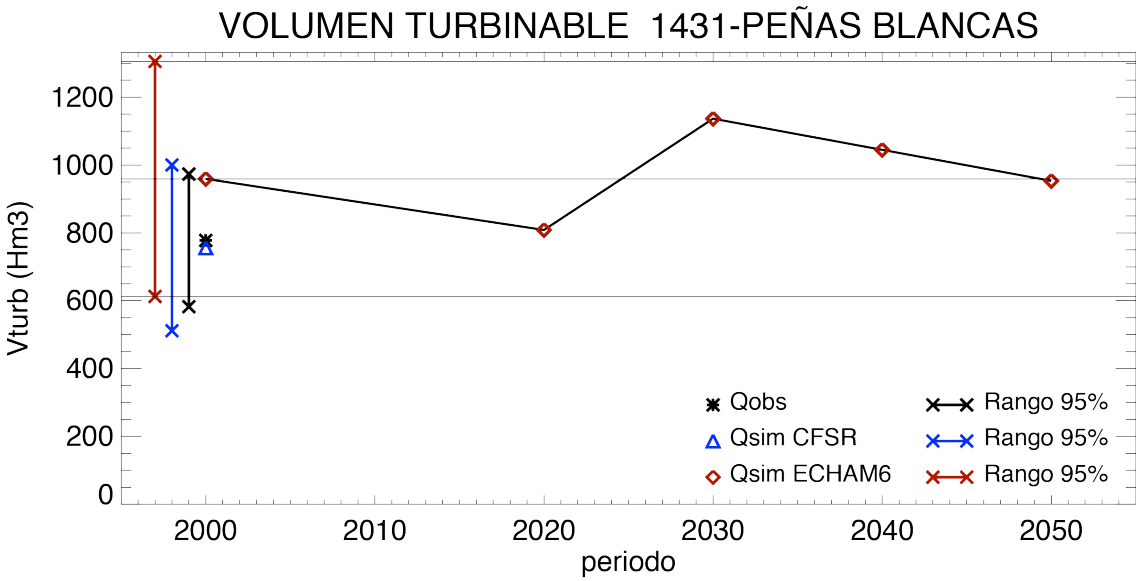


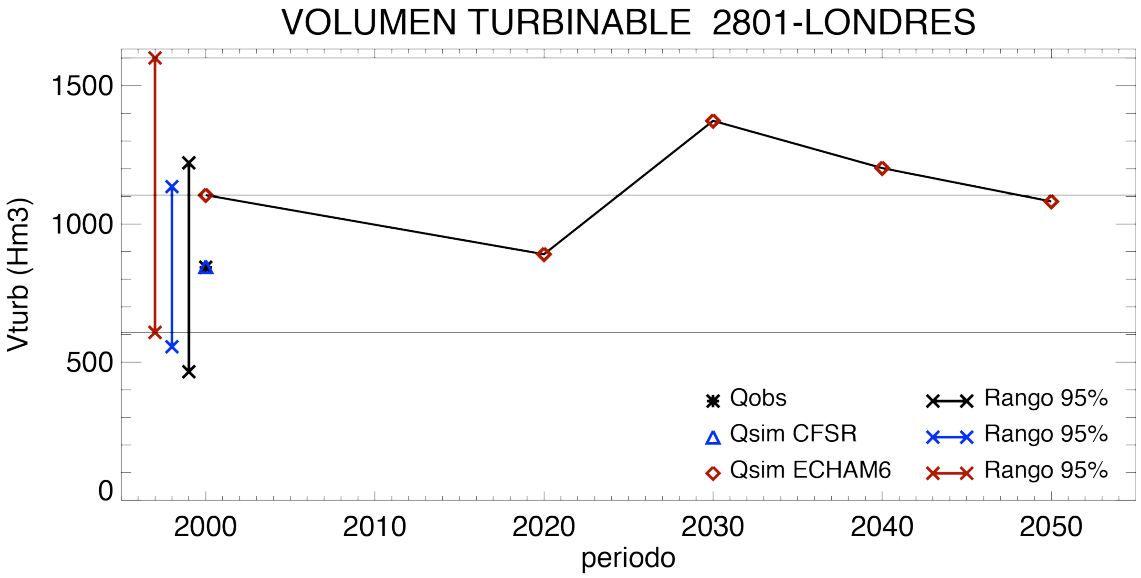


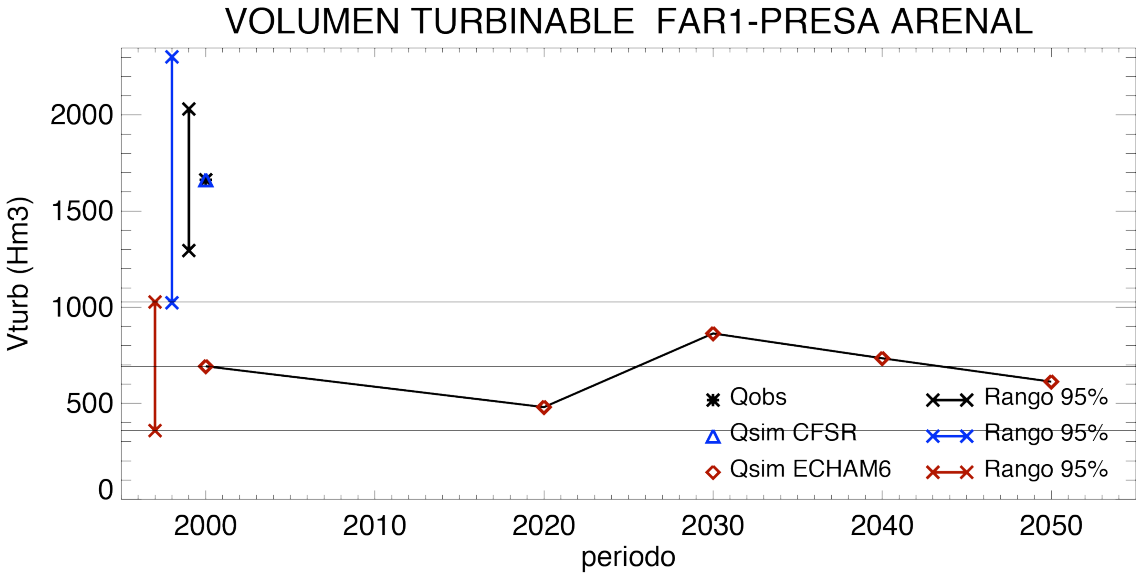

VOLUMEN TURBINABLE 0909-ORIENTE
Vturb (Hm3)
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

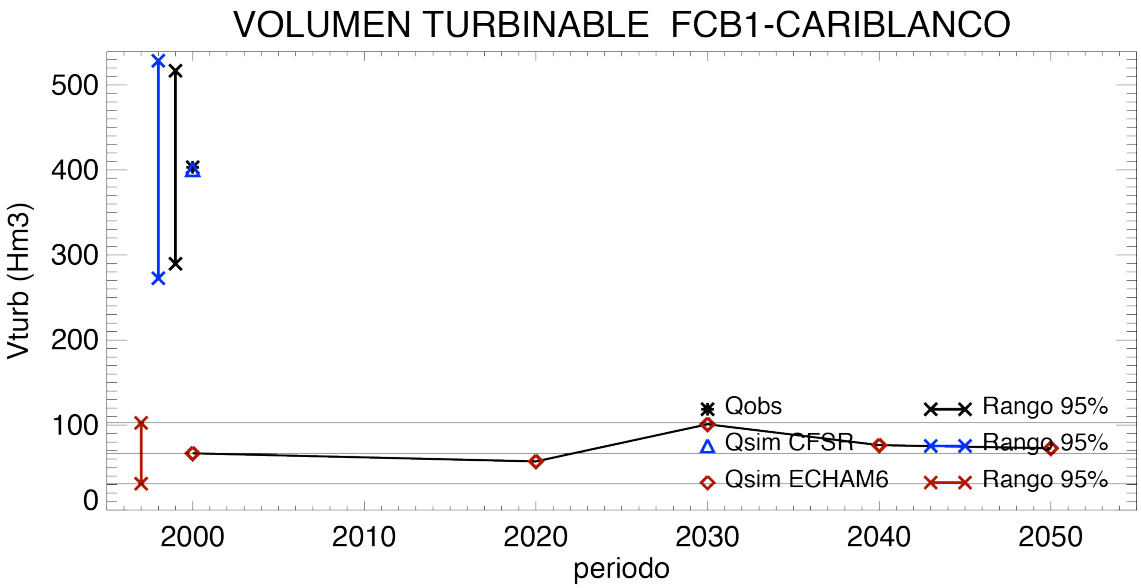

VOLUMEN TURBINABLE 0912-PASCUA
Vturb (Hm3)
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

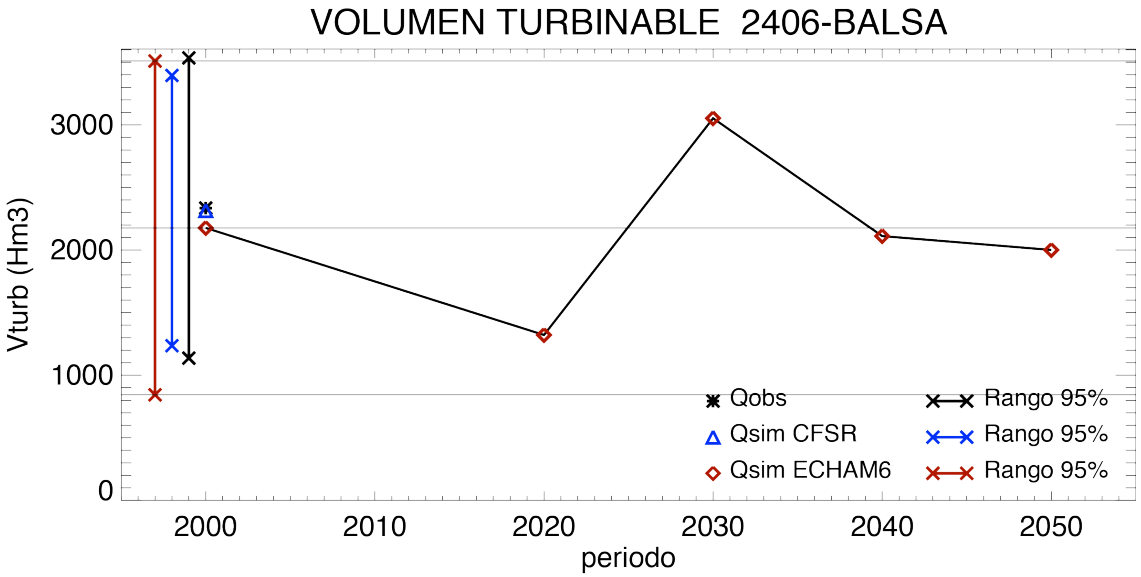

VOLUMEN TURBINABLE F001-TORO1
Vturb (Hm3)
400
300
200
100
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

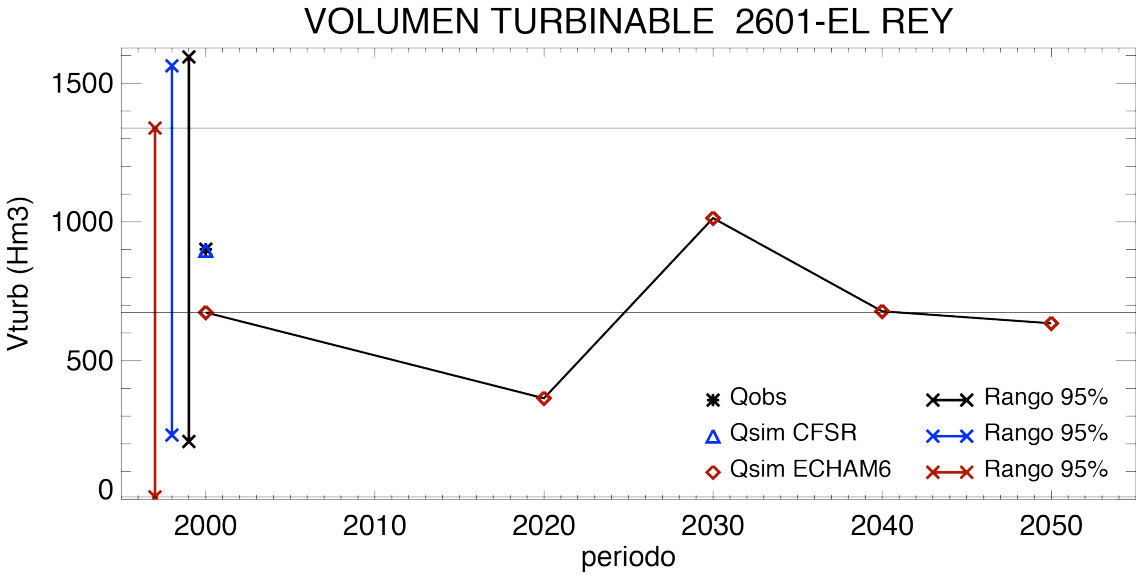

VOLUMEN TURBINABLE 1431-PEÑAS BLANCAS
Vturb (Hm3)
1200
1000
800
600
400
200
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

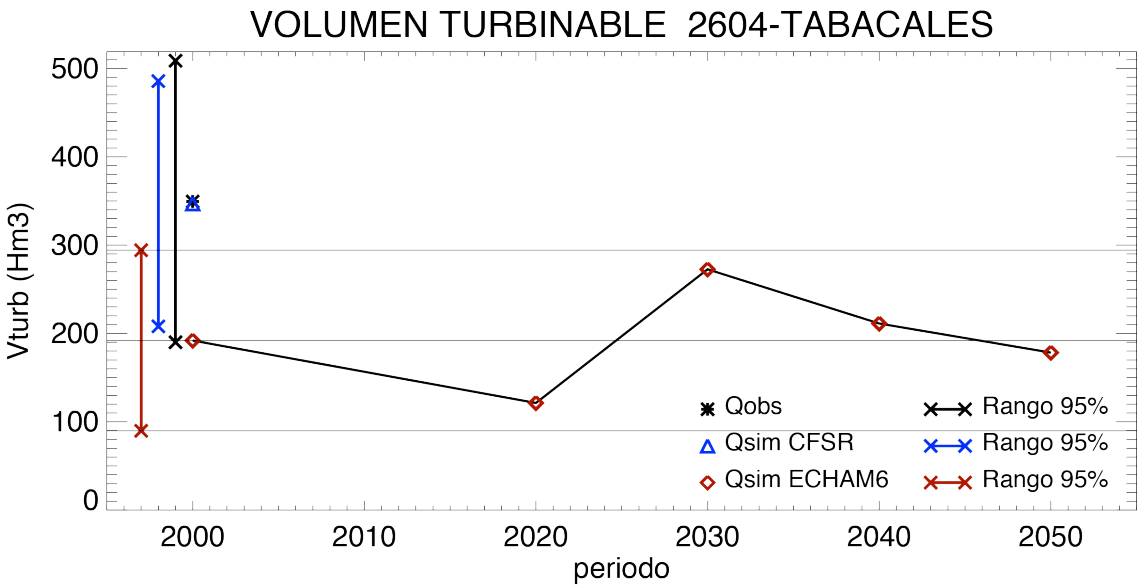

VOLUMEN TURBINABLE 2801-LONDRES
Vturb (Hm3)
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

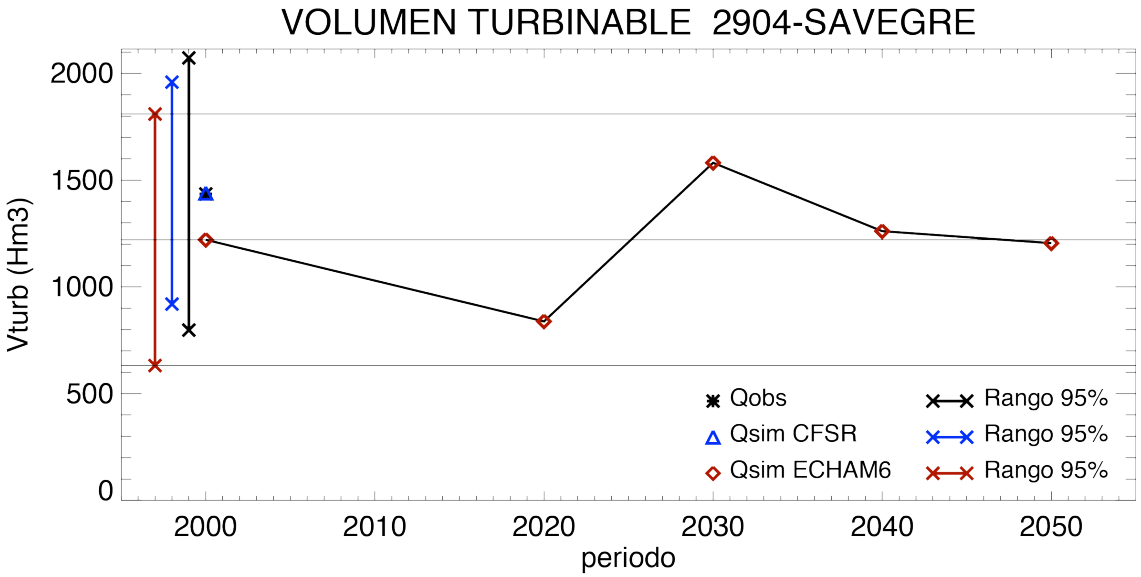

VOLUMEN TURBINABLE FAR1-PRESA ARENAL
Vturb (Hm3)
2000
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

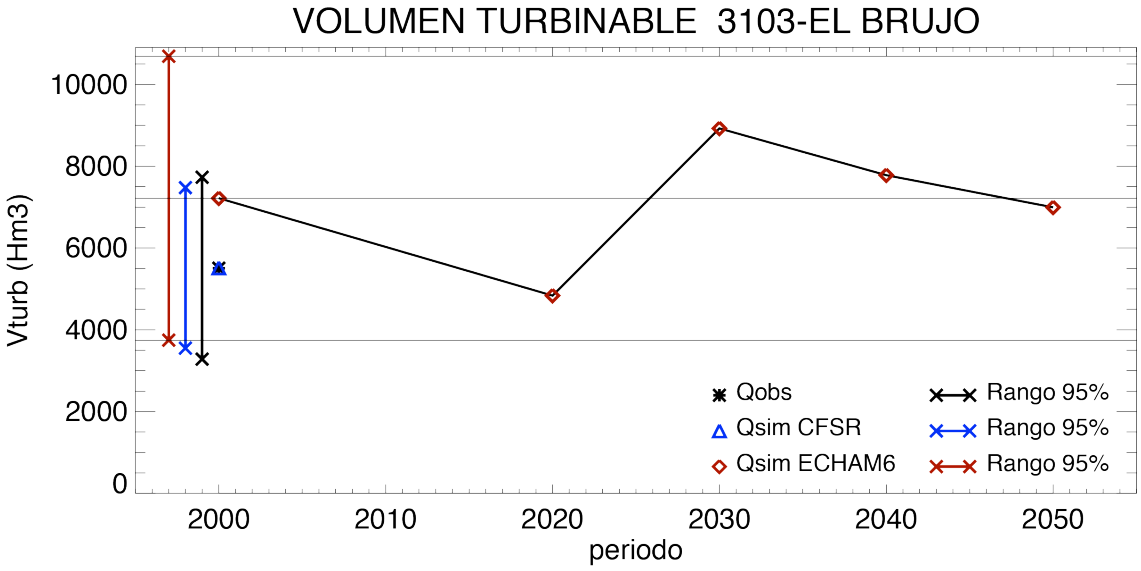

VOLUMEN TURBINABLE FCB1-CARIBLANCO
Vturb (Hm3)
500
400
300
200
100
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

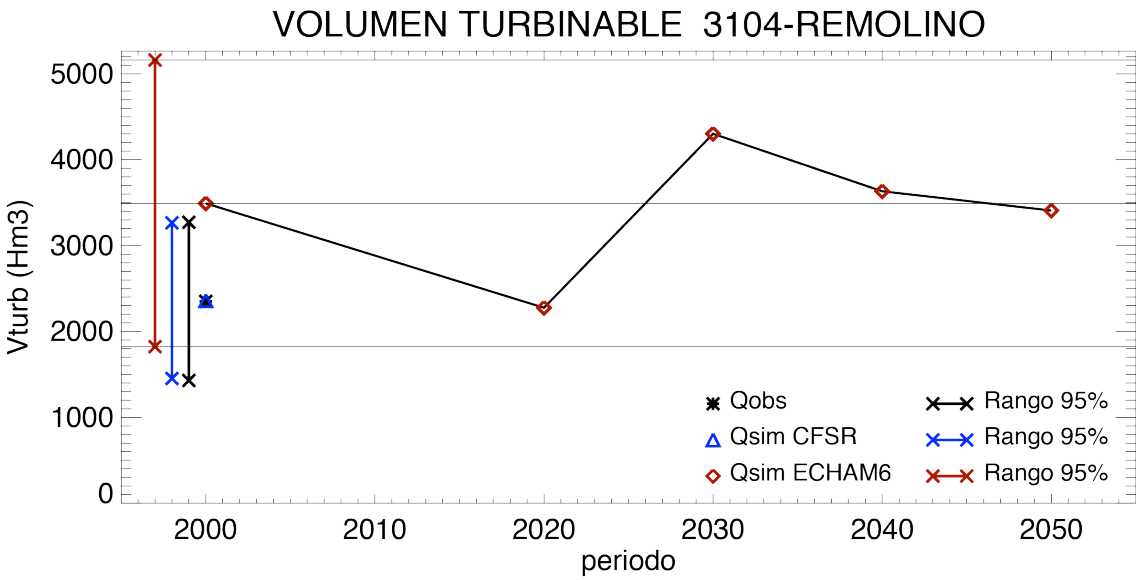

VOLUMEN TURBINABLE 2406-BALSA
Vturb (Hm3)
3000
2000
1000
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

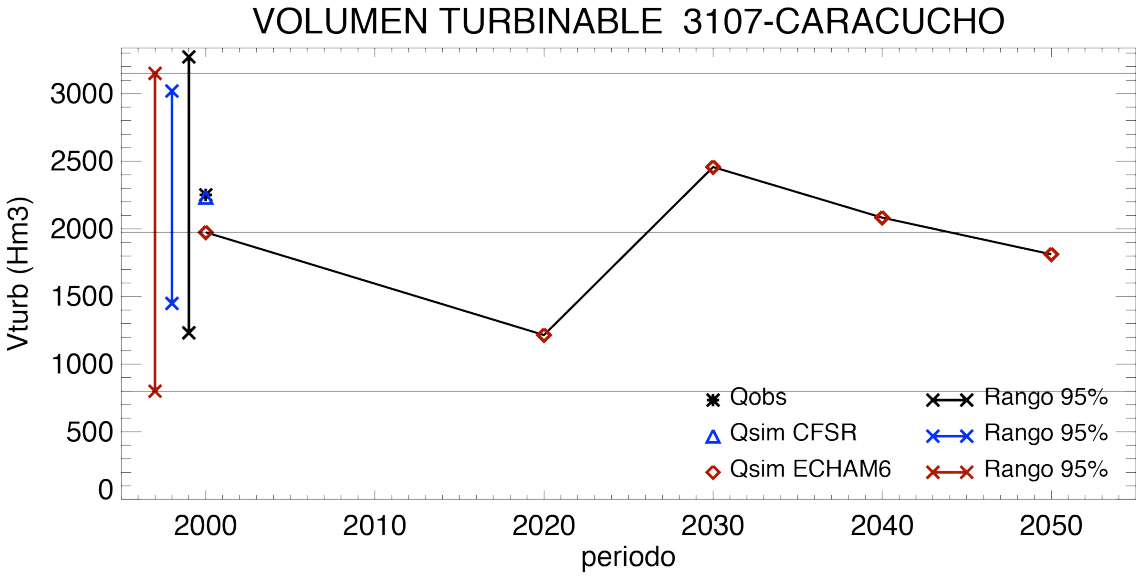

VOLUMEN TURBINABLE 2601-EL REY
Vturb (Hm3)
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%


VOLUMEN TURBINABLE 2604-TABACALES
Vturb (Hm3)
500
400
300
200
100
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

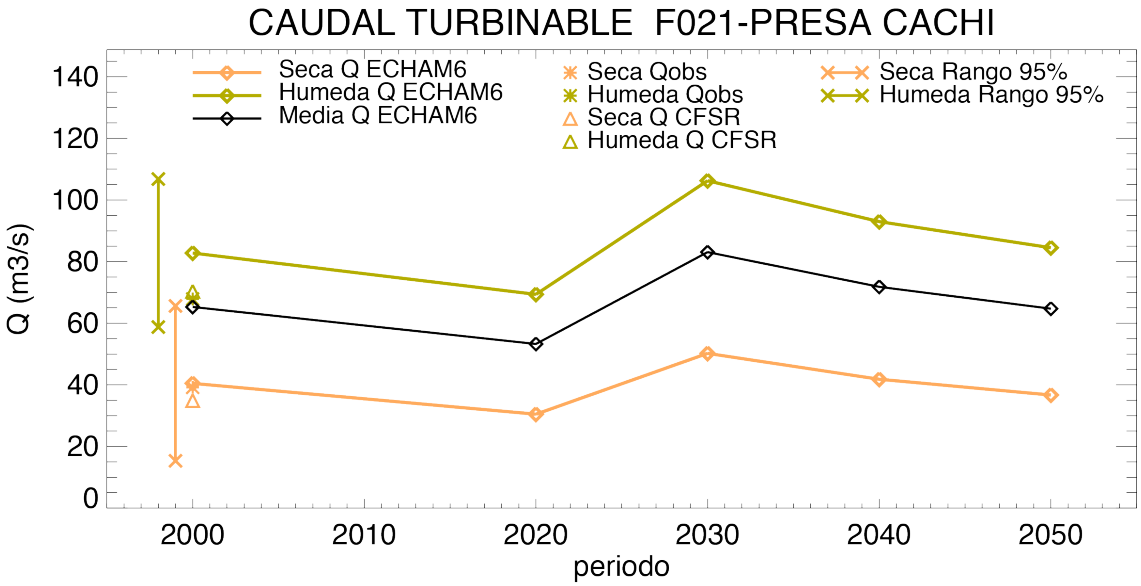

VOLUMEN TURBINABLE 2904-SAVEGRE
Vturb (Hm3)
2000
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

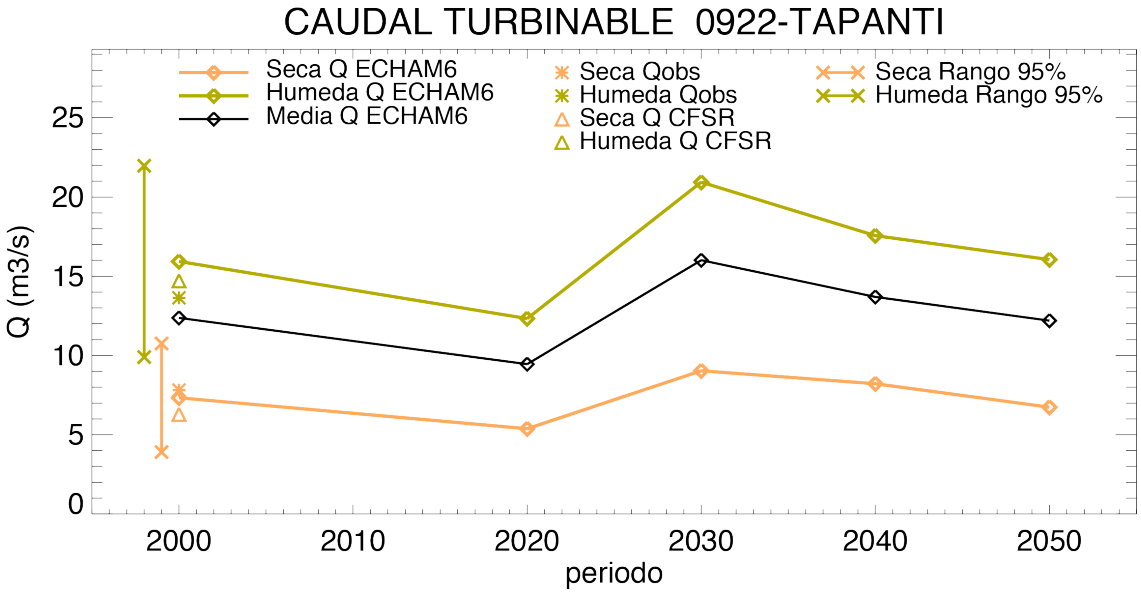

VOLUMEN TURBINABLE 3103-EL BRUJO
Vturb (Hm3)
10000
8000
6000
4000
2000
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

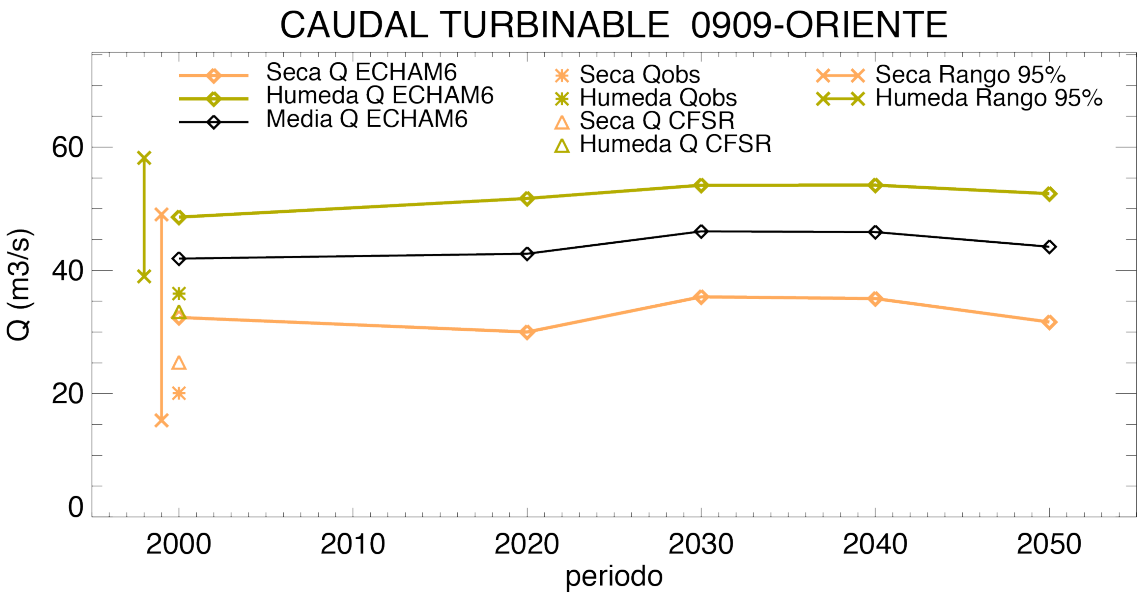

VOLUMEN TURBINABLE 3104-REMOLINO
Vturb (Hm3)
5000
4000
3000
2000
1000
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

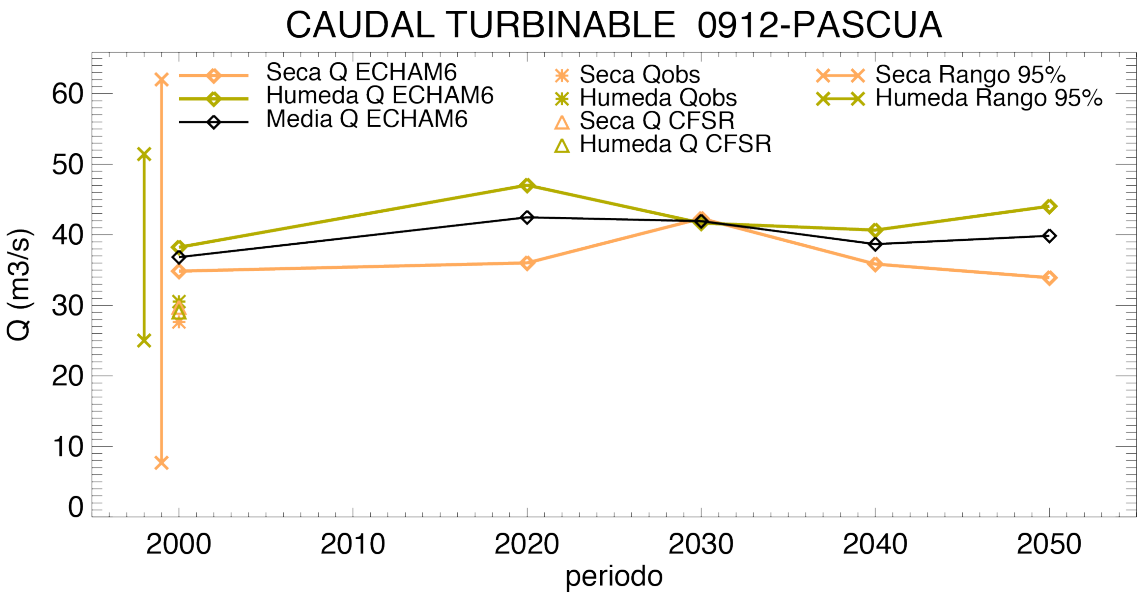

VOLUMEN TURBINABLE 3107-CARACUCHO
Vturb (Hm3)
3000
2500
2000
1500
1000
500
0
2000
2010
2020
2030
2040
2050
periodo
Qobs
Qsim CFSR
Qsim ECHAM6
Rango 95%
Rango 95%
Rango 95%

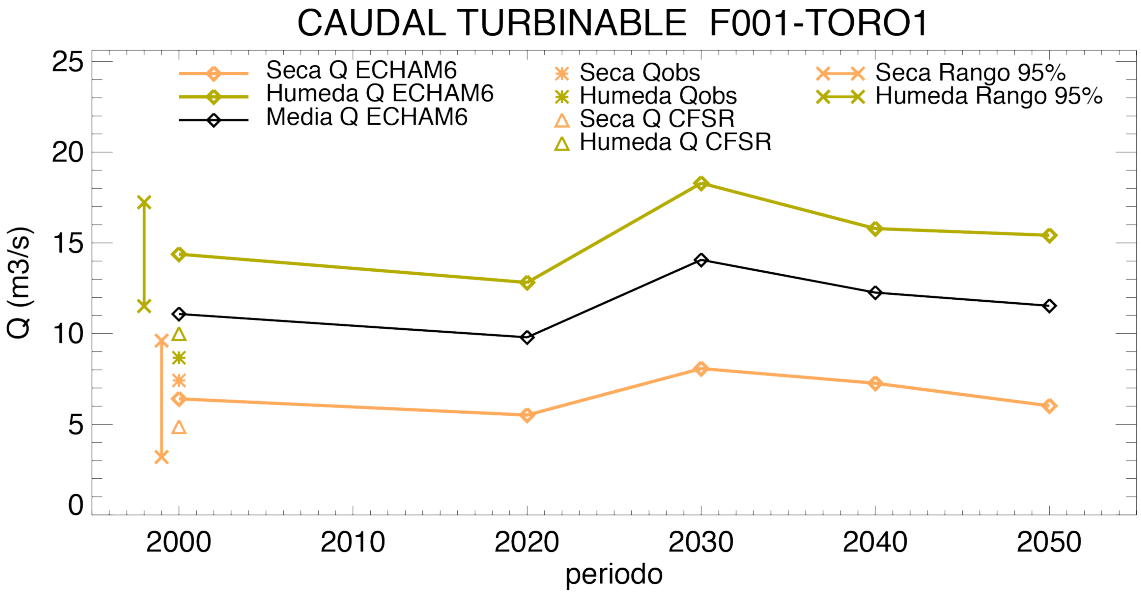
Anejo 7: Figuras de caudal turbinable para época seca y época húmeda

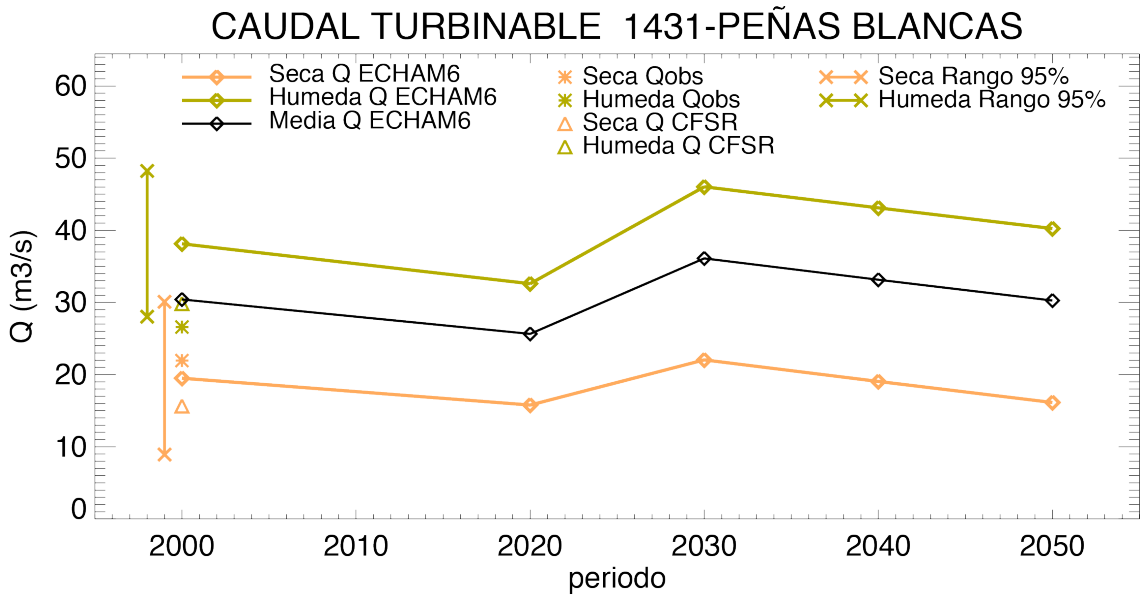


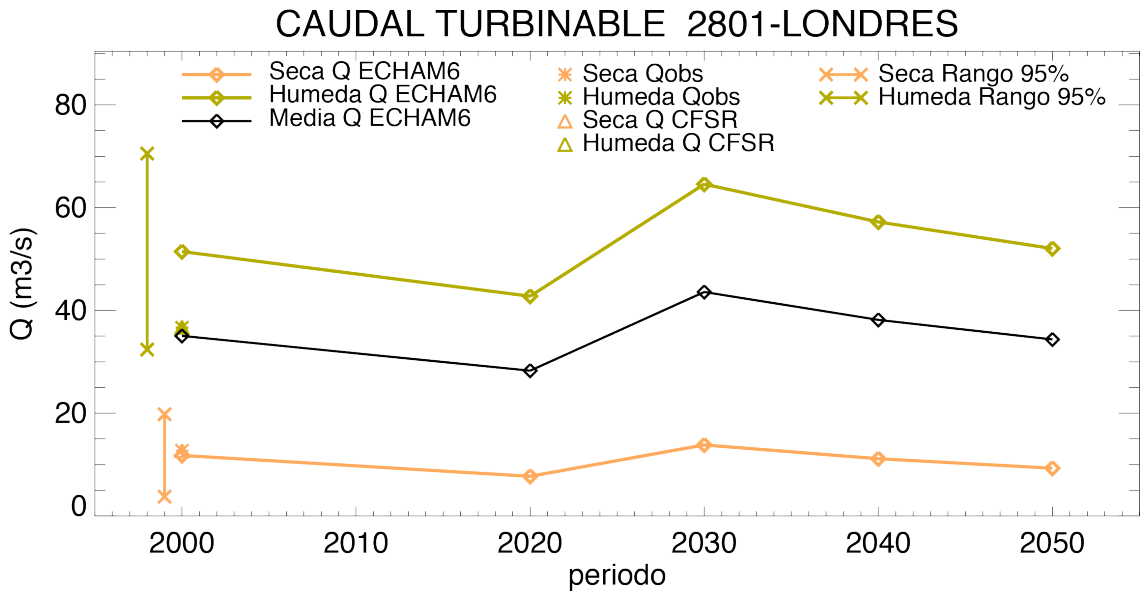


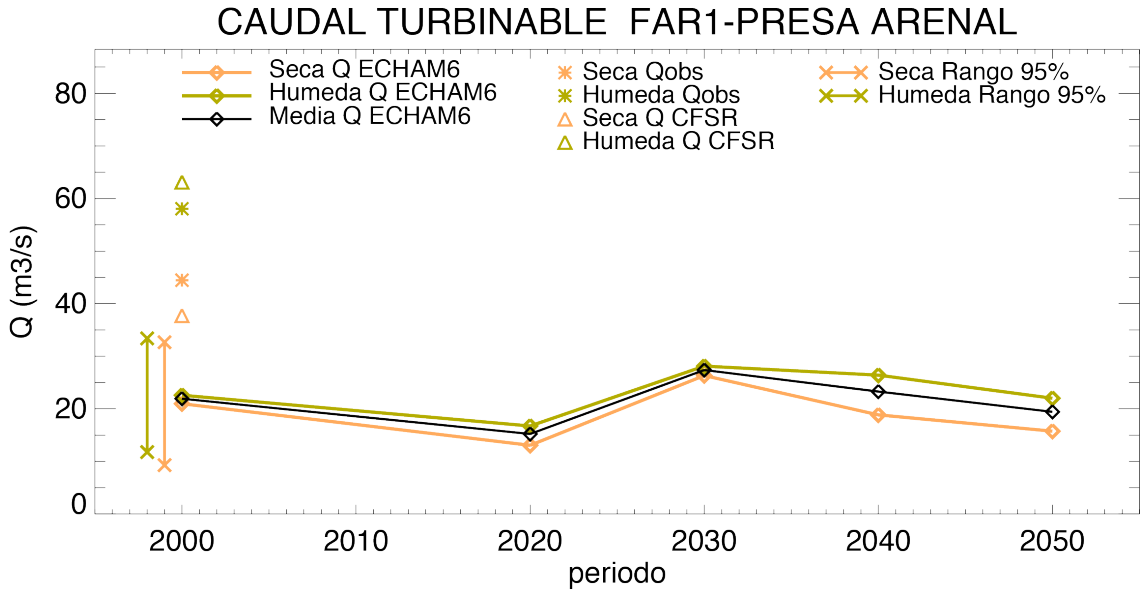

CAUDAL TURBINABLE 0909-ORIENTE
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
20
40
60
2000
2010
2020
2030
2040
2050
periodo

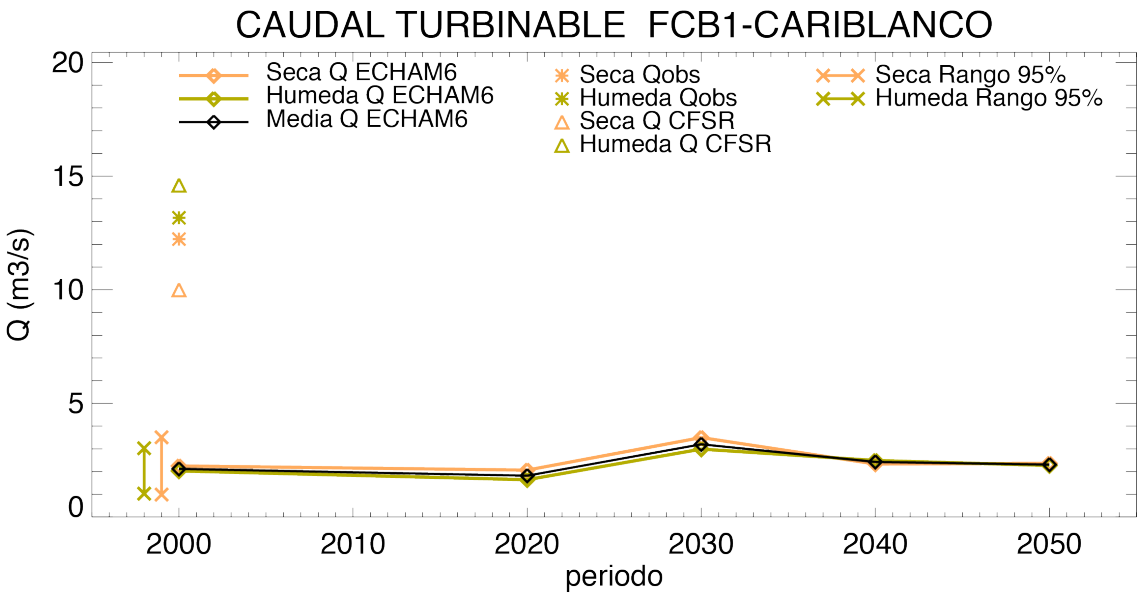

CAUDAL TURBINABLE 0912-PASCUA
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
10
20
30
40
50
60
2000
2010
2020
2030
2040
2050
periodo

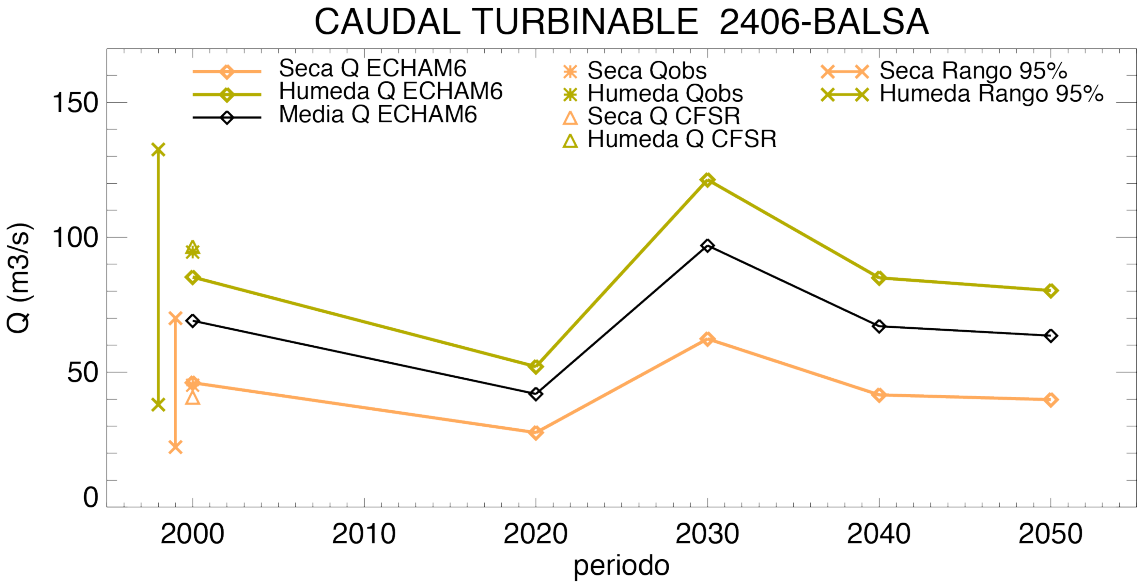

CAUDAL TURBINABLE F001-TORO1
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050
periodo

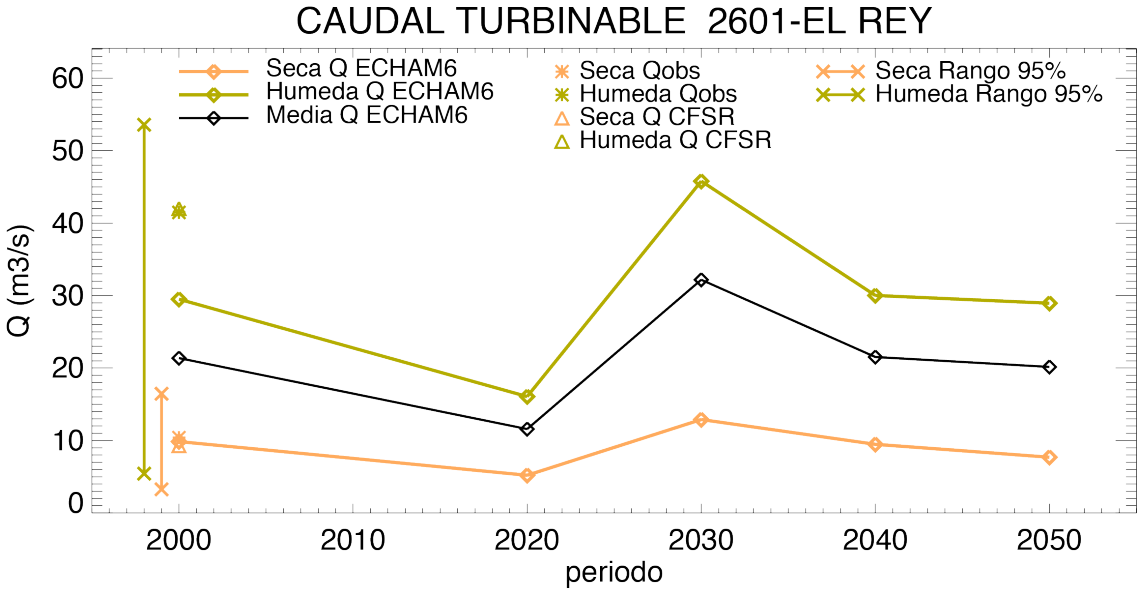

CAUDAL TURBINABLE 1431-PEÑAS BLANCAS
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
10
20
30
40
50
60
2000
2010
2020
2030
2040
2050
periodo

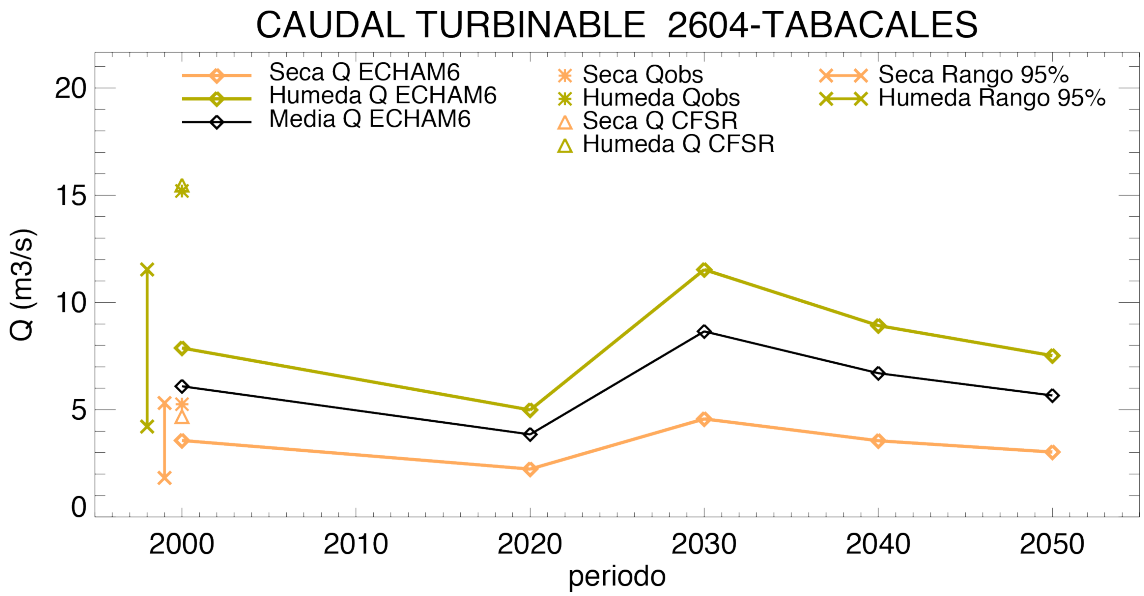

CAUDAL TURBINABLE 2801-LONDRES
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

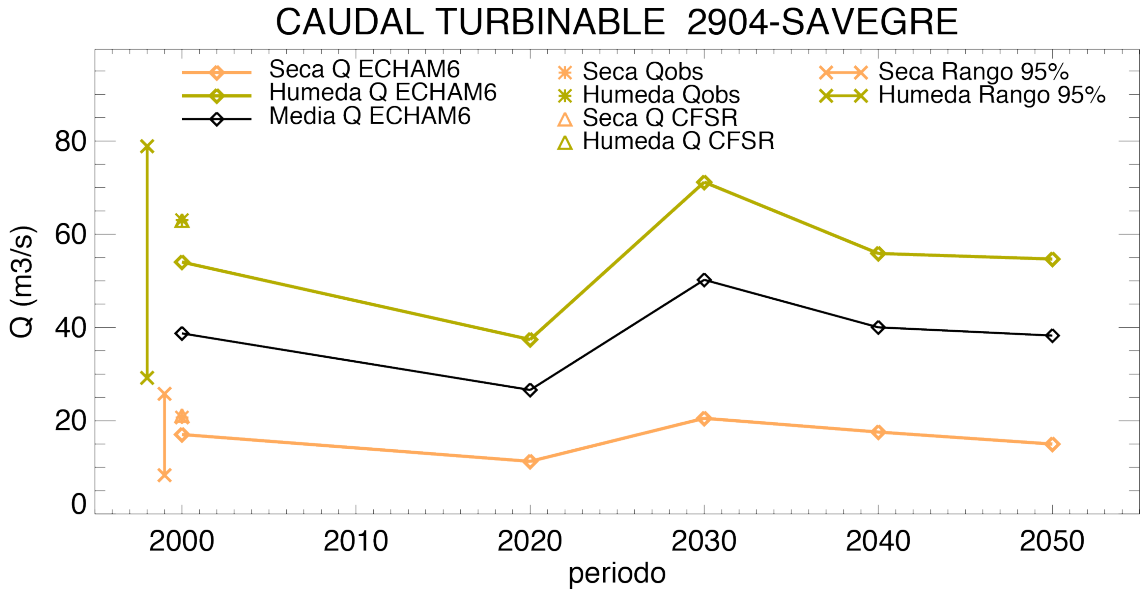

CAUDAL TURBINABLE FAR1-PRESA ARENAL
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

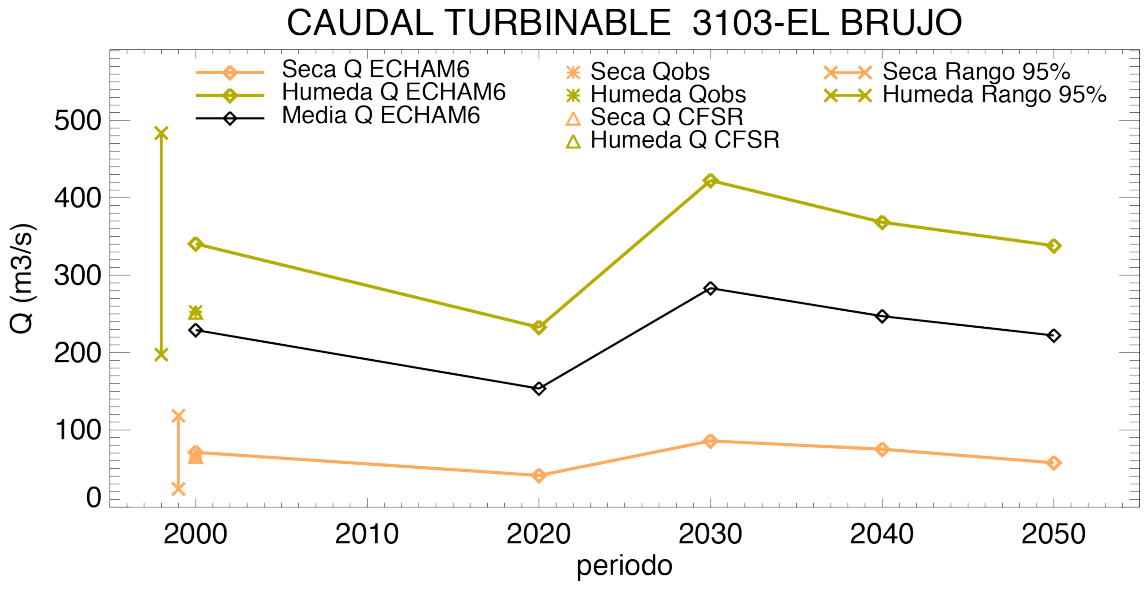

CAUDAL TURBINABLE FCB1-CARIBLANCO
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
5
10
15
20
2000
2010
2020
2030
2040
2050

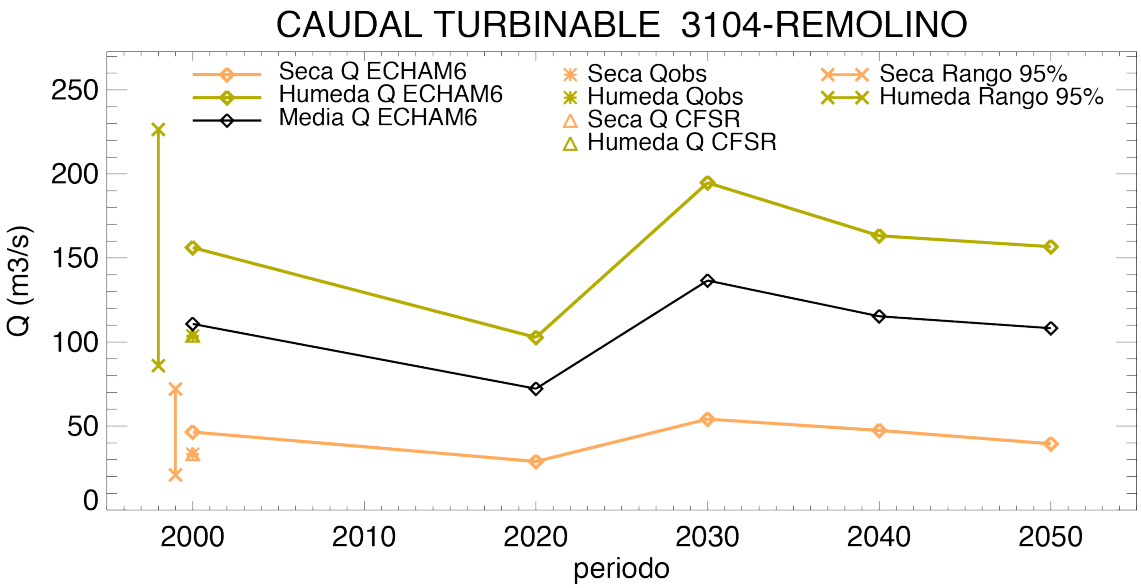

CAUDAL TURBINABLE 2406-BALSA
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
50
100
150
2000
2010
2020
2030
2040
2050

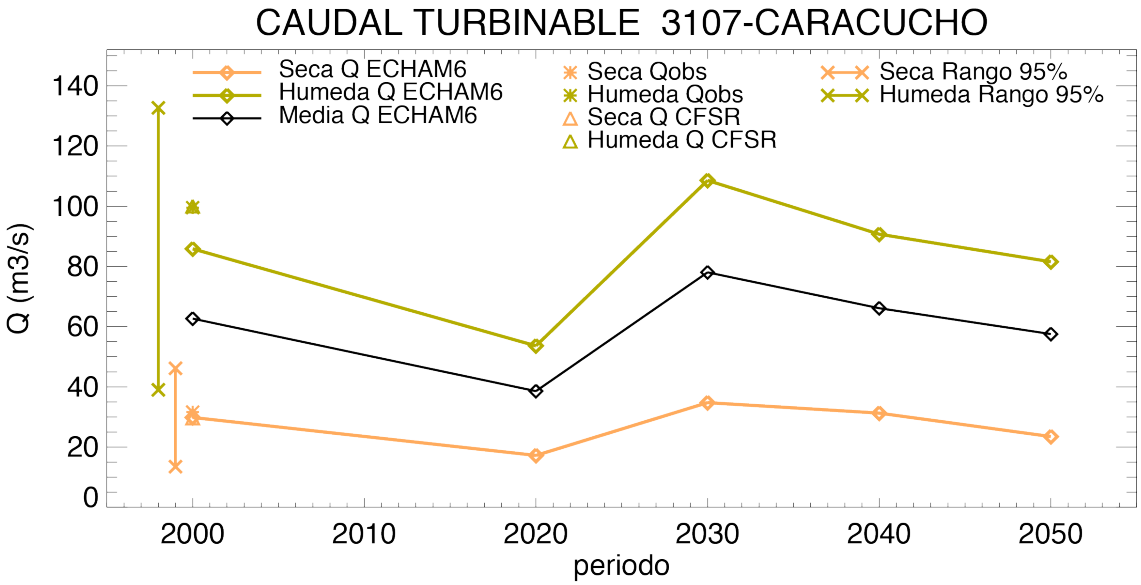

CAUDAL TURBINABLE 2601-EL REY
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
10
20
30
40
50
60
2000
2010
2020
2030
2040
2050


CAUDAL TURBINABLE 2604-TABACALES
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
5
10
15
20
2000
2010
2020
2030
2040
2050

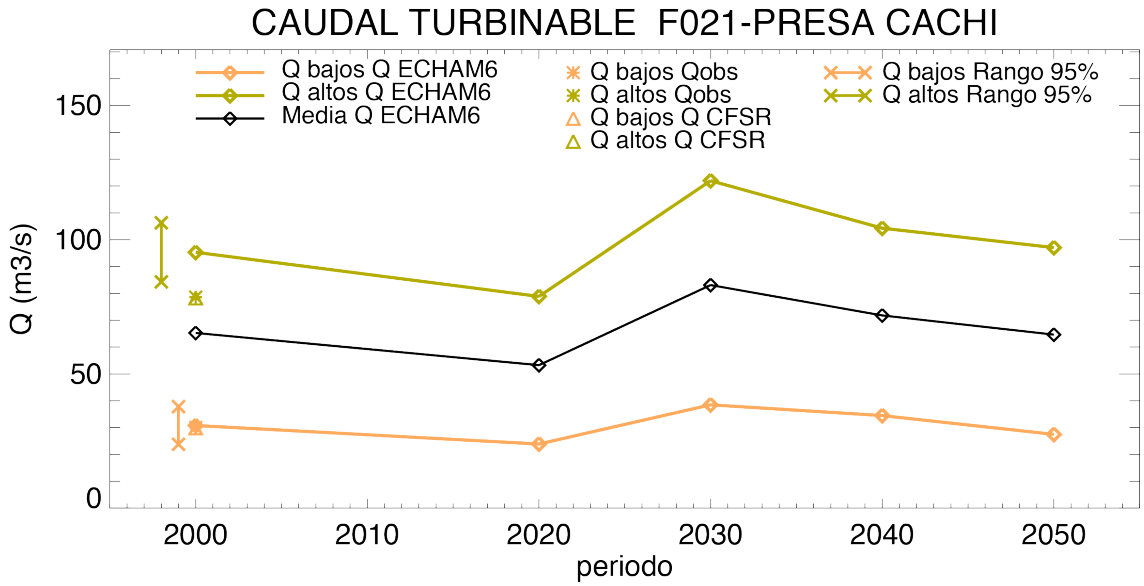

CAUDAL TURBINABLE 2904-SAVEGRE
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
20
40
60
80
2000
2010
2020
2030
2040
2050

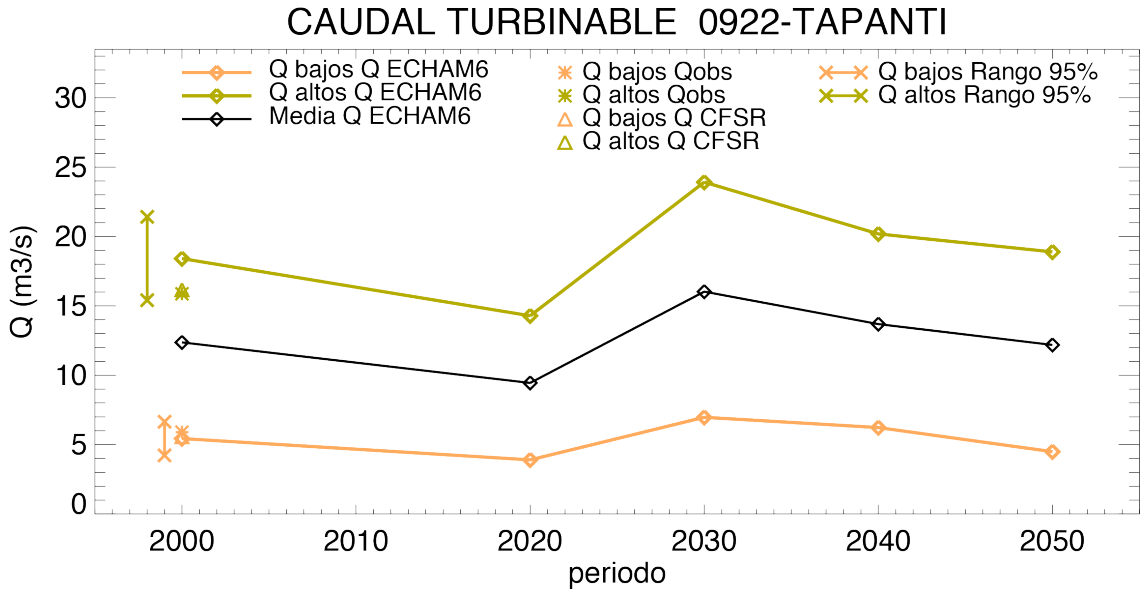

CAUDAL TURBINABLE 3103-EL BRUJO
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
periodo
0
100
200
300
400
500
2000
2010
2020
2030
2040
2050

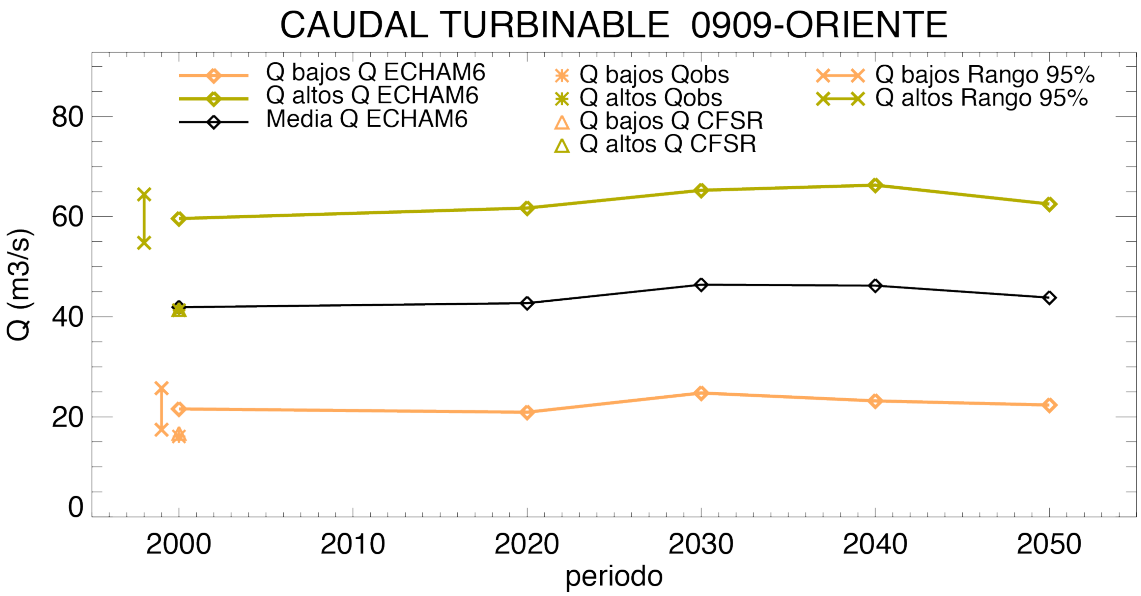

CAUDAL TURBINABLE 3104-REMOLINO
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
50
100
150
200
250
2000
2010
2020
2030
2040
2050
periodo

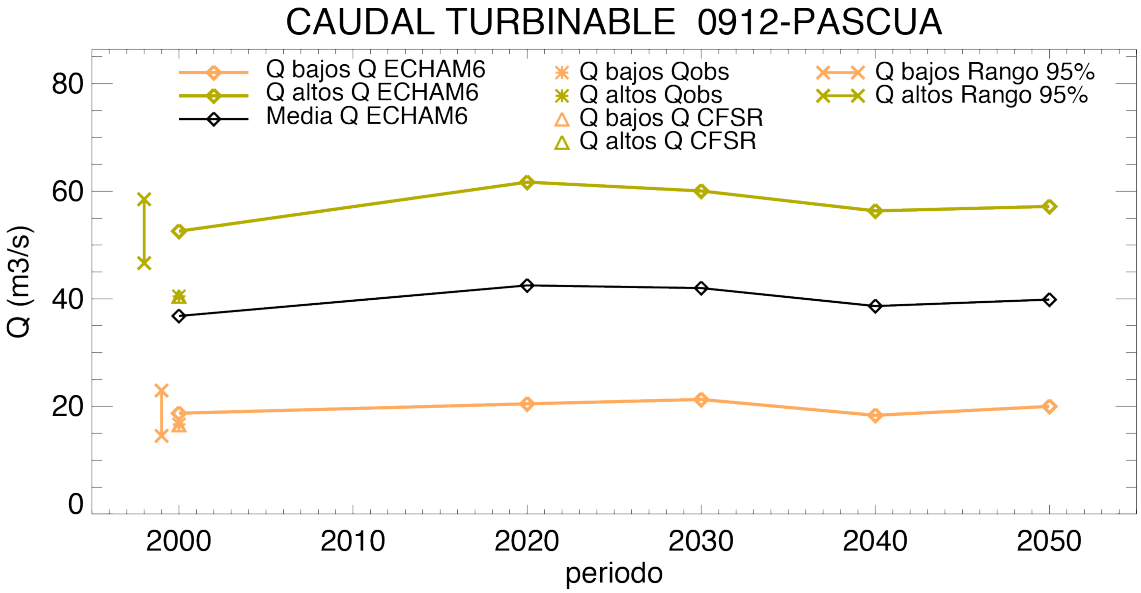

CAUDAL TURBINABLE 3107-CARACUCHO
Seca Q ECHAM6
Humeda Q ECHAM6
Media Q ECHAM6
Seca Qobs
Humeda Qobs
Seca Q CFSR
Humeda Q CFSR
Seca Rango 95%
Humeda Rango 95%
Q (m3/s)
0
20
40
60
80
100
120
140
2000
2010
2020
2030
2040
2050
periodo

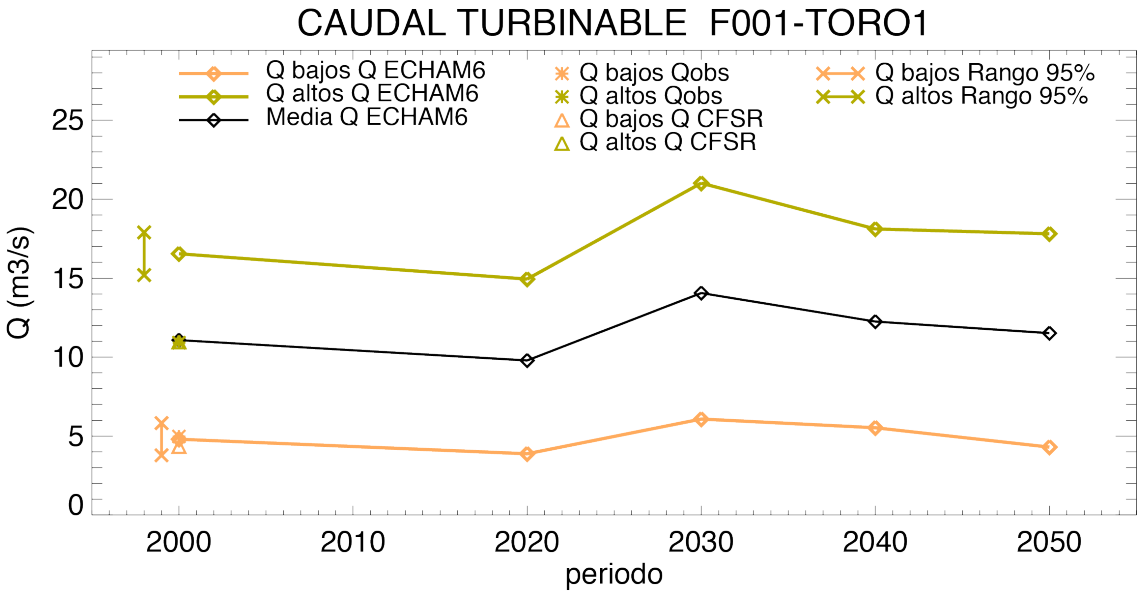
Anejo 8: Figuras de caudal turbinable para caudales altos y caudales bajos

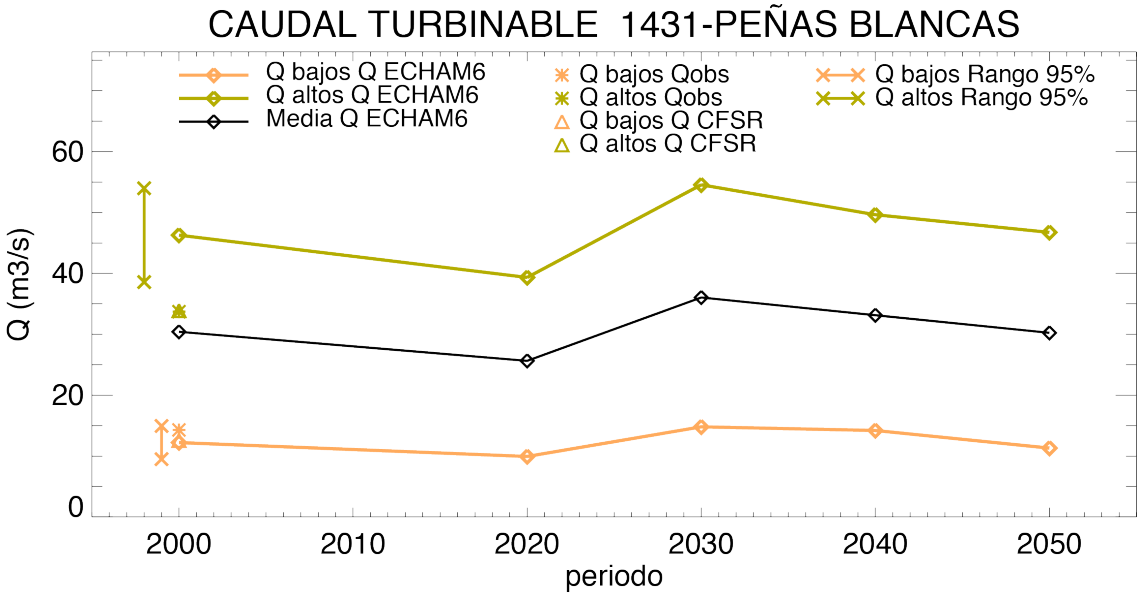


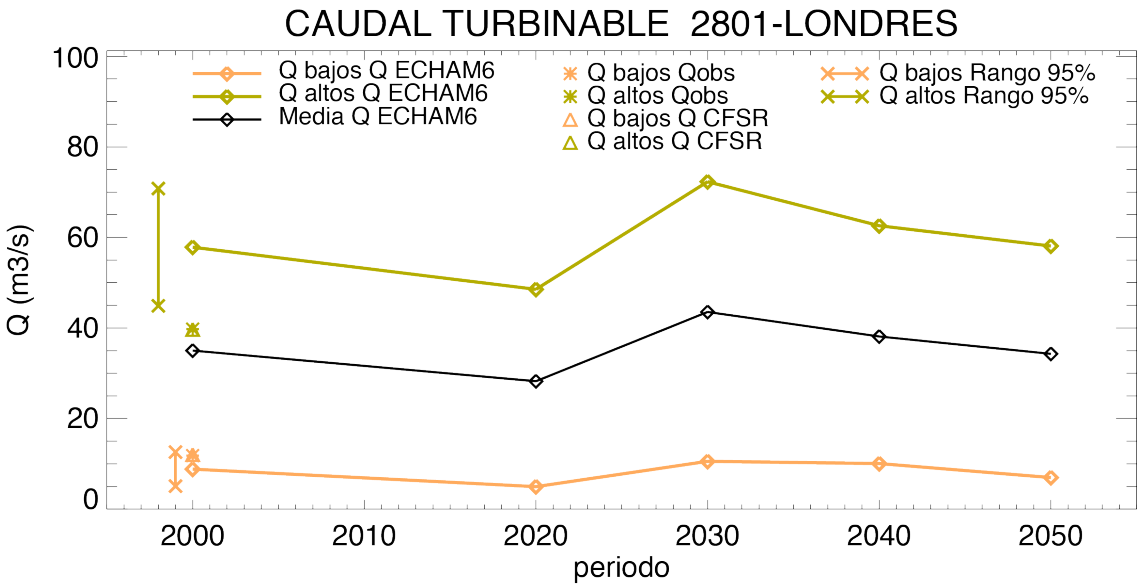


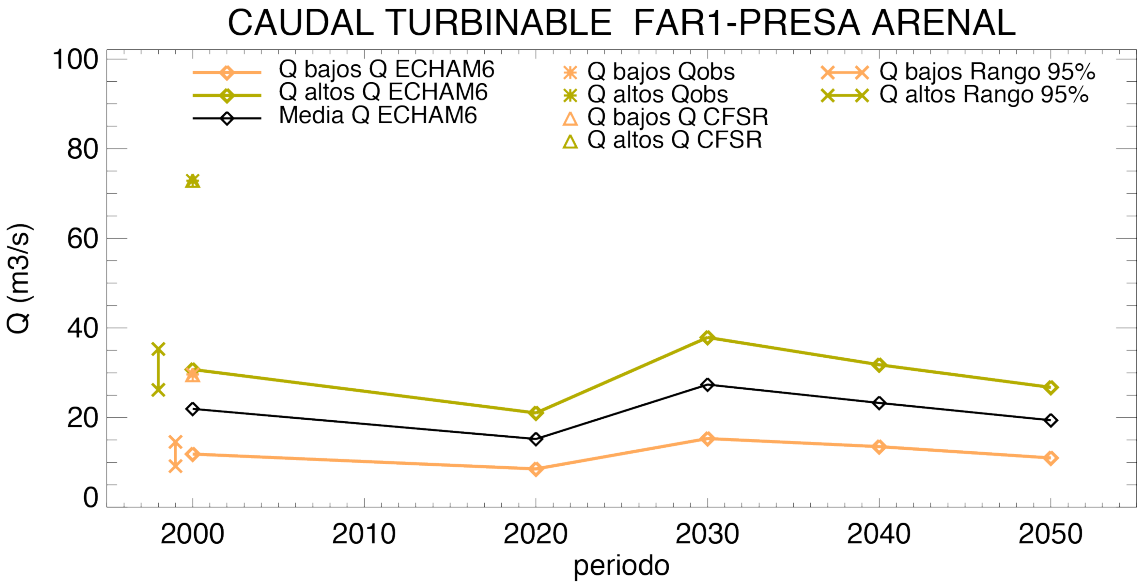

CAUDAL TURBINABLE 0909-ORIENTE
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

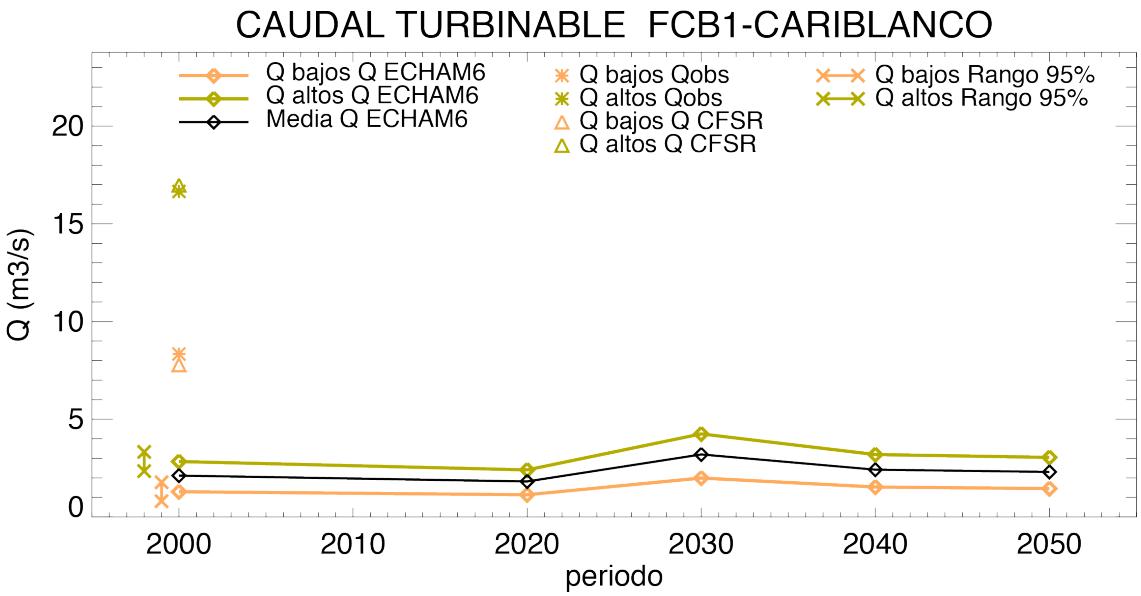

CAUDAL TURBINABLE 0912-PASCUA
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

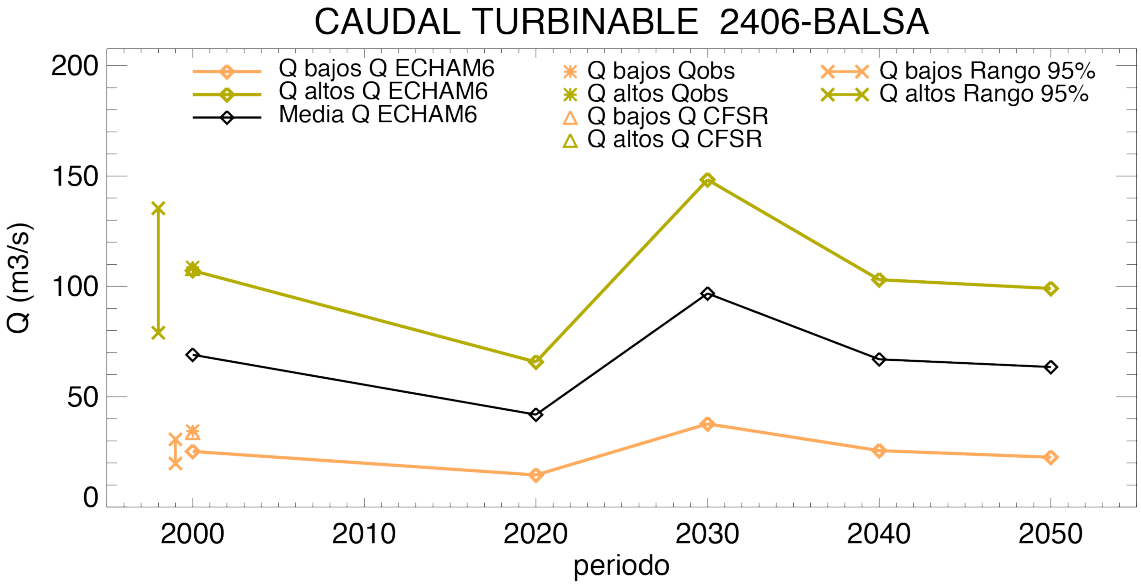

CAUDAL TURBINABLE F001-TORO1
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050
periodo

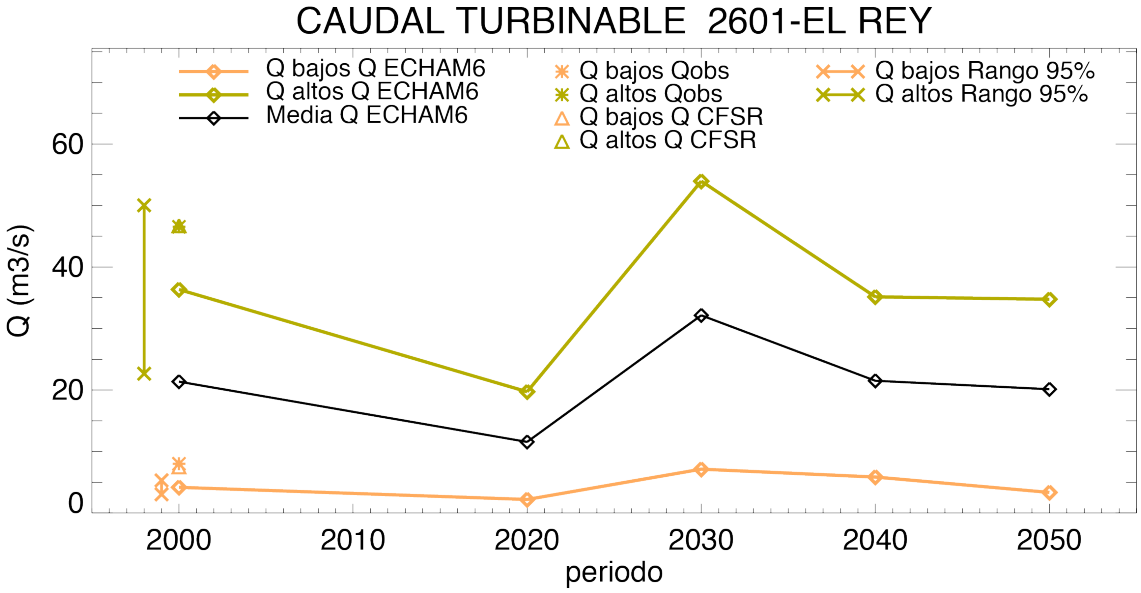

CAUDAL TURBINABLE 1431-PEÑAS BLANCAS
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
2000
2010
2020
2030
2040
2050
periodo

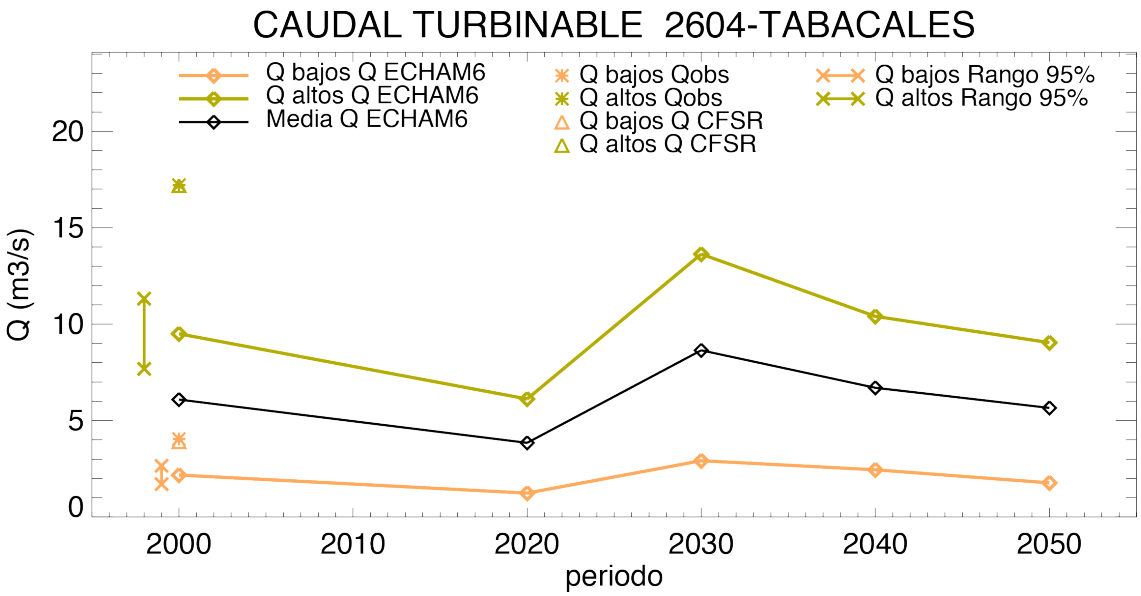

CAUDAL TURBINABLE 2801-LONDRES
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
80
100
2000
2010
2020
2030
2040
2050
periodo

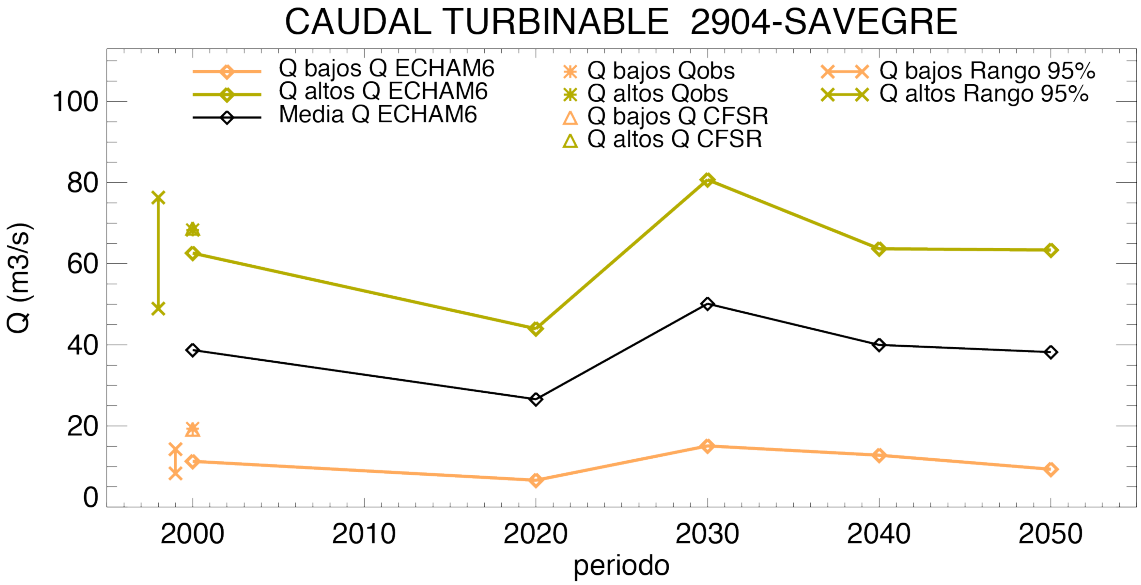

CAUDAL TURBINABLE FAR1-PRESA ARENAL
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
80
100
2000
2010
2020
2030
2040
2050
periodo

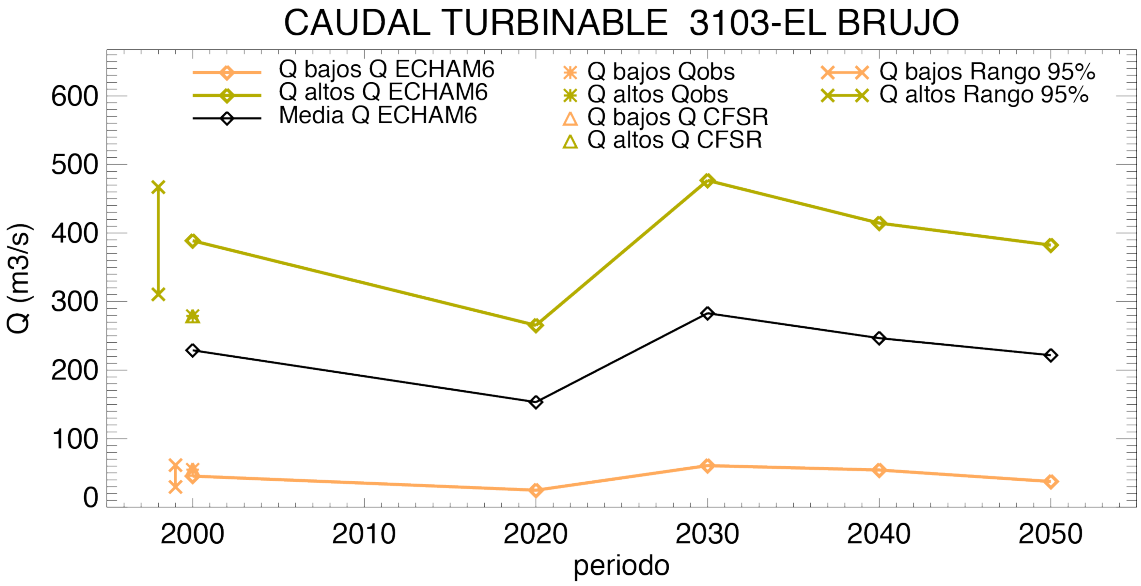

CAUDAL TURBINABLE FCB1-CARIBLANCO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
5
10
15
20
2000
2010
2020
2030
2040
2050
periodo

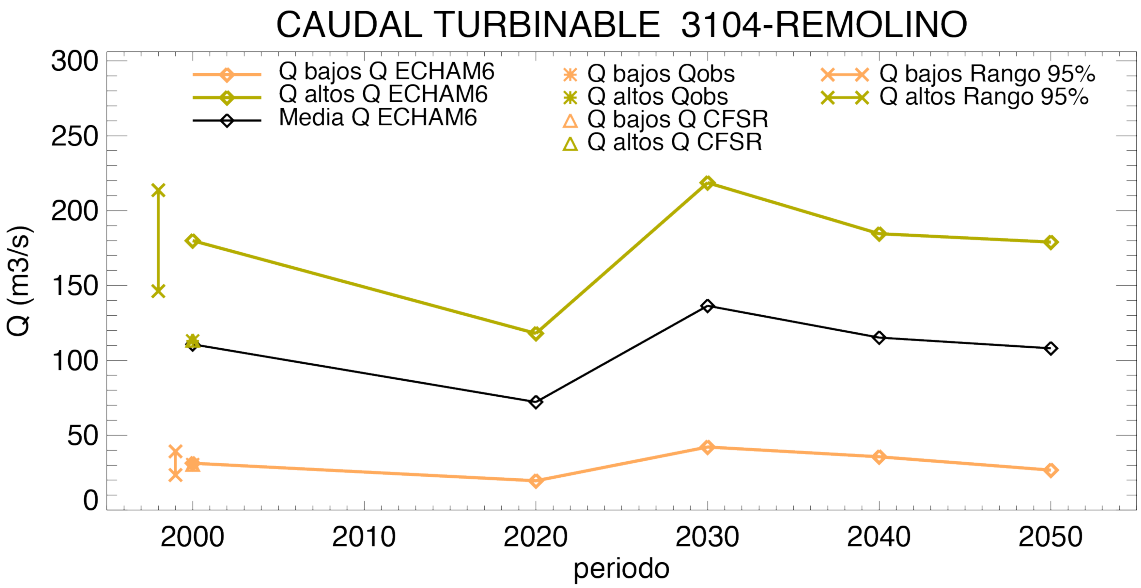

CAUDAL TURBINABLE 2406-BALSA
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
50
100
150
200
2000
2010
2020
2030
2040
2050
periodo

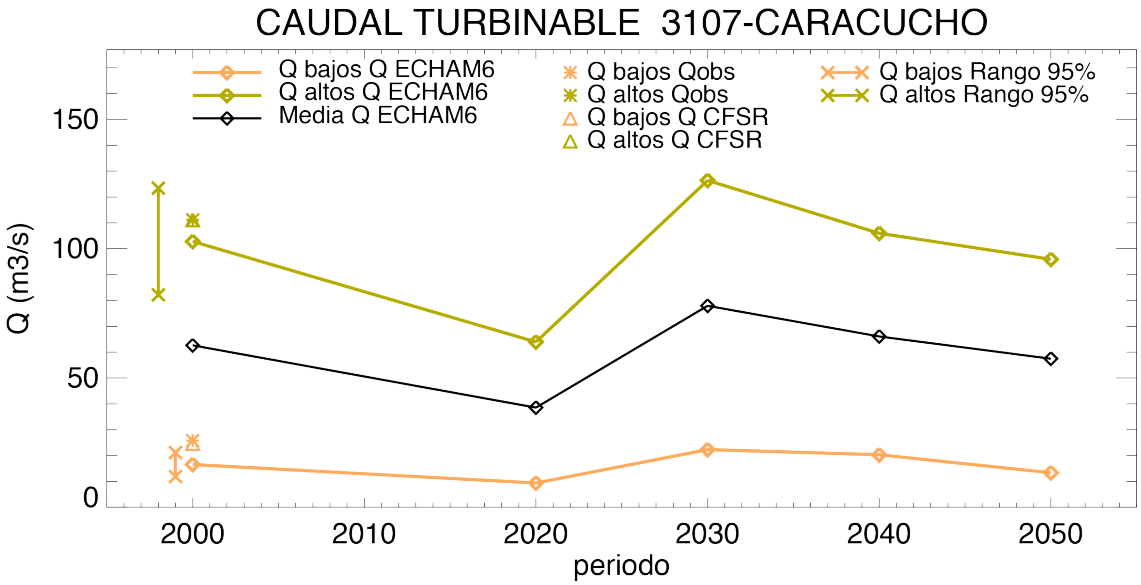

CAUDAL TURBINABLE 2601-EL REY
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
2000
2010
2020
2030
2040
2050
periodo


CAUDAL TURBINABLE 2604-TABACALES
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
5
10
15
20
2000
2010
2020
2030
2040
2050
periodo

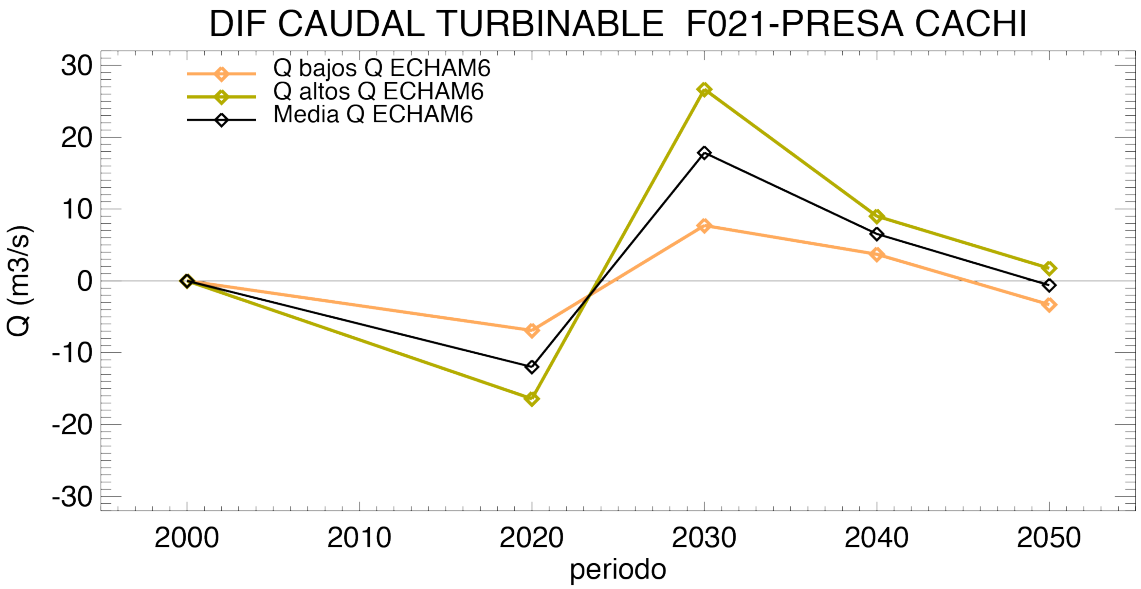

CAUDAL TURBINABLE 2904-SAVEGRE
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
20
40
60
80
100
2000
2010
2020
2030
2040
2050
periodo

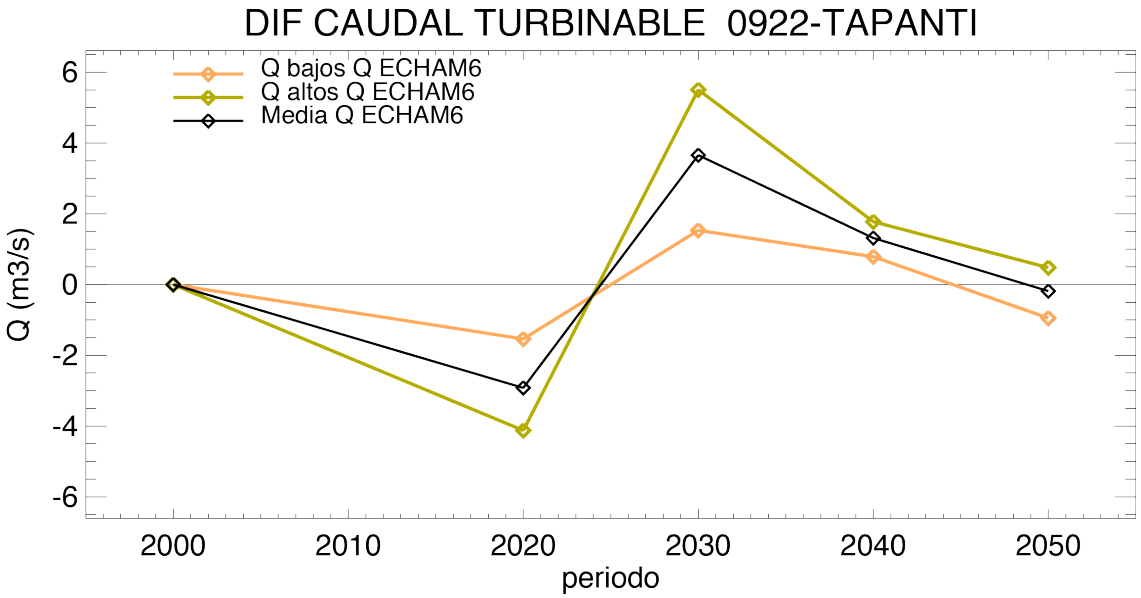

CAUDAL TURBINABLE 3103-EL BRUJO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
0
100
200
300
400
500
600
2000
2010
2020
2030
2040
2050
periodo

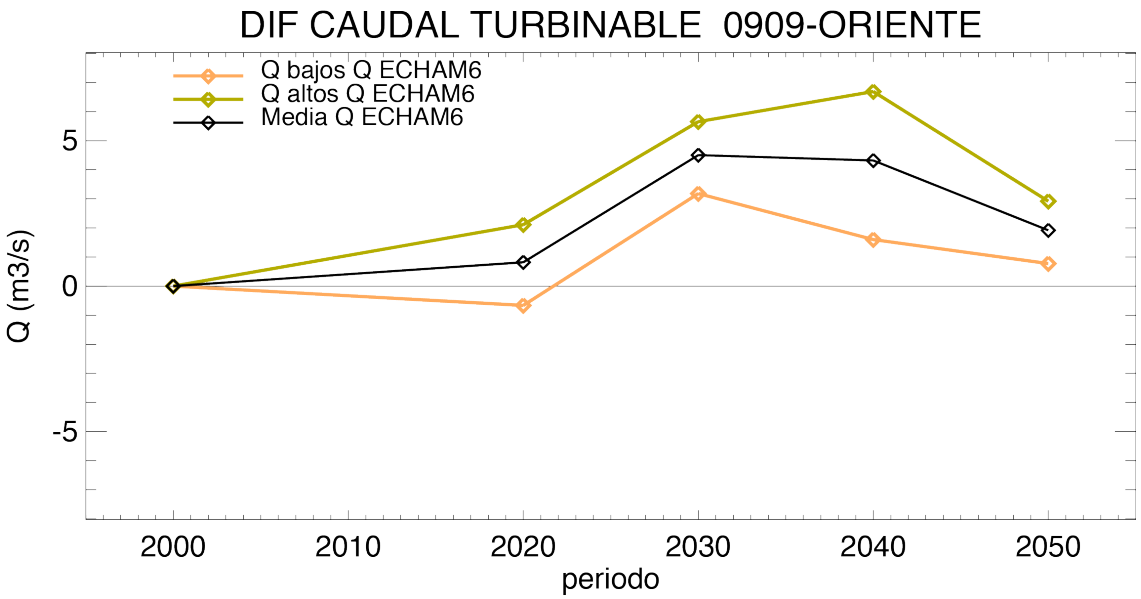

CAUDAL TURBINABLE 3104-REMOLINO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
300
250
200
150
100
50
0
2000
2010
2020
2030
2040
2050
periodo

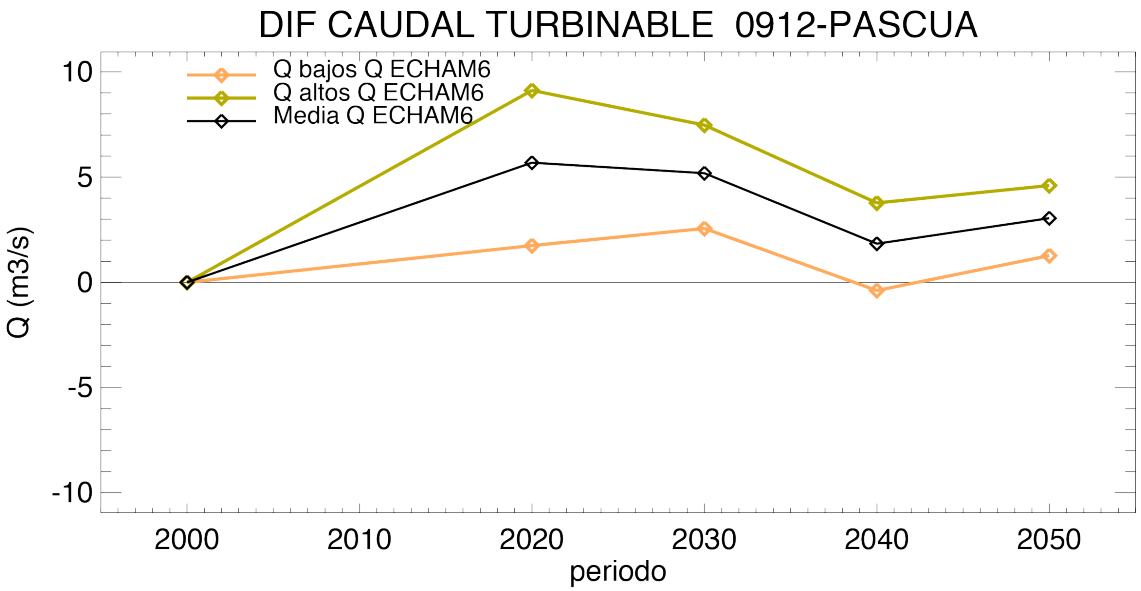

CAUDAL TURBINABLE 3107-CARACUCHO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q bajos Qobs
Q altos Qobs
Q bajos Q CFSR
Q altos Q CFSR
Q bajos Rango 95%
Q altos Rango 95%
Q (m3/s)
150
100
50
0
2000
2010
2020
2030
2040
2050
periodo

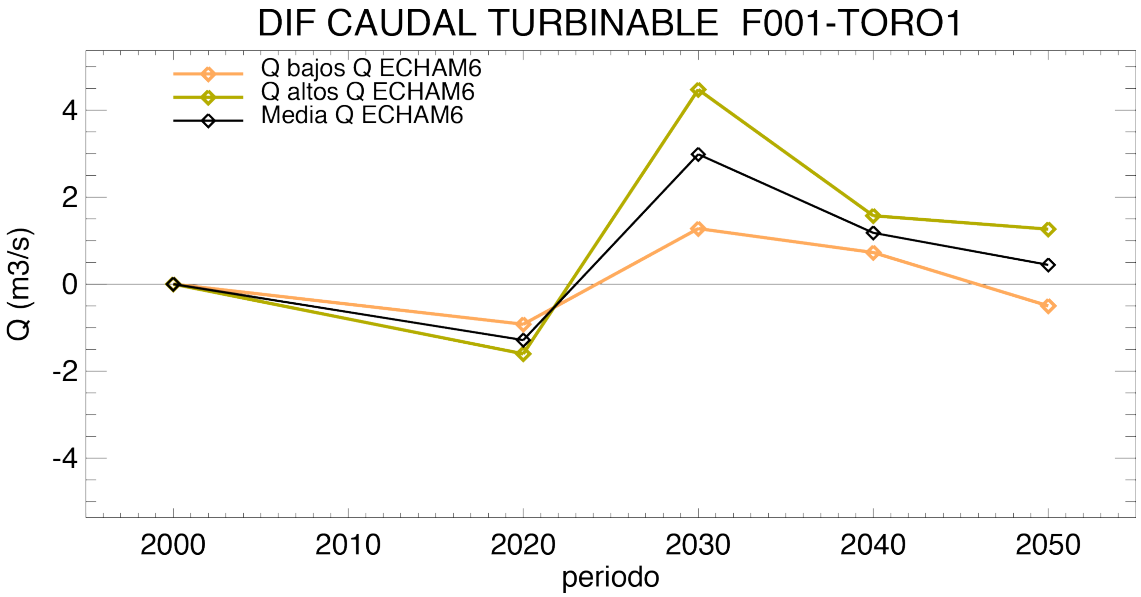
Anejo 9: Figuras de diferencia de caudal turbinable para caudales altos y caudales bajos

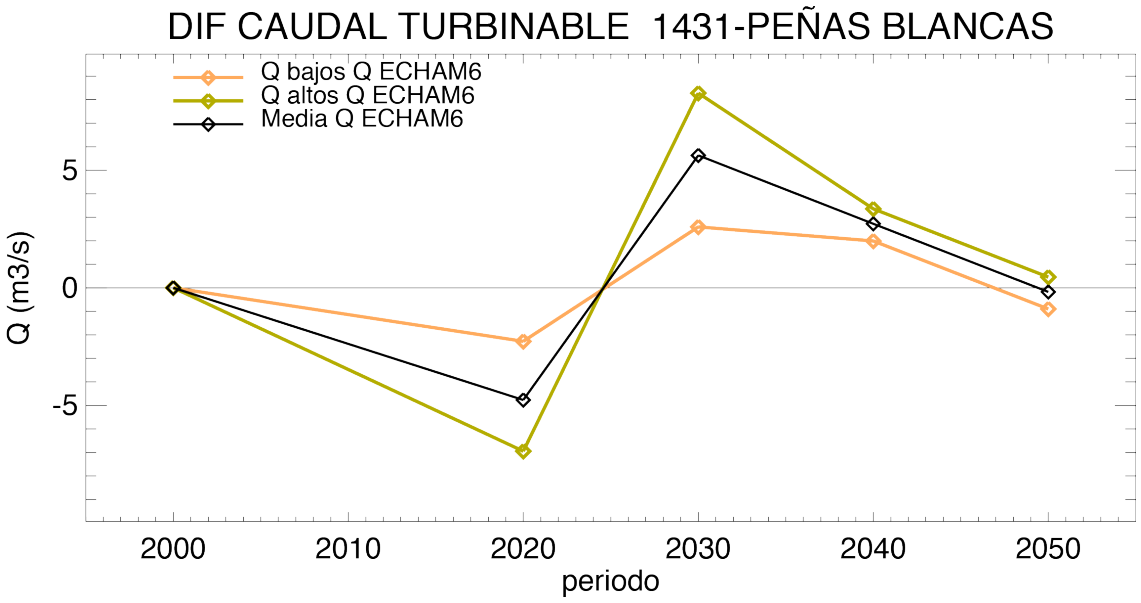


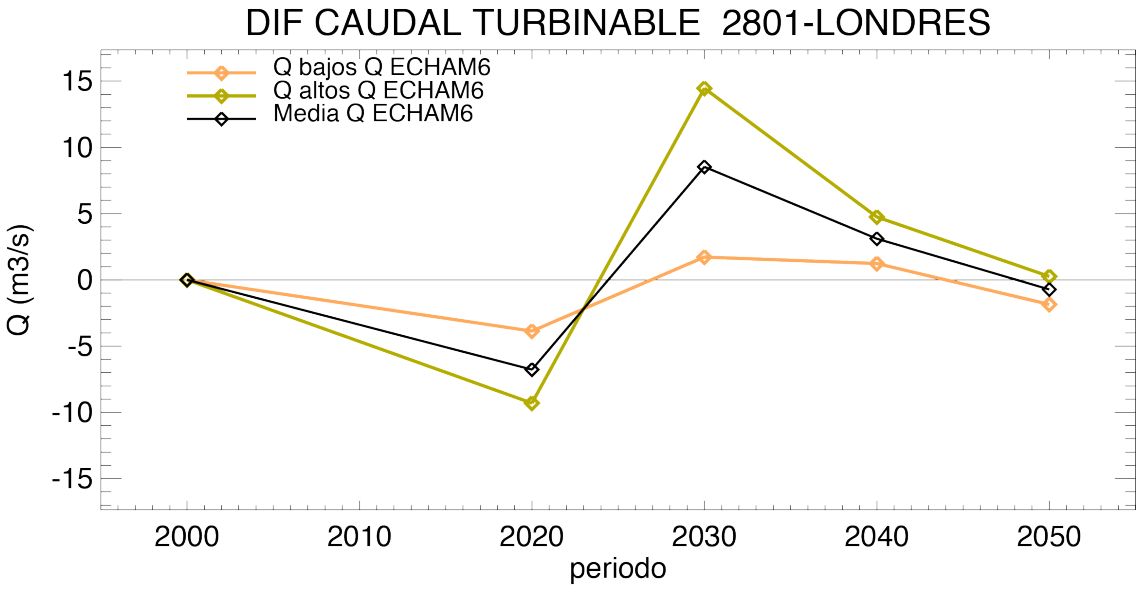


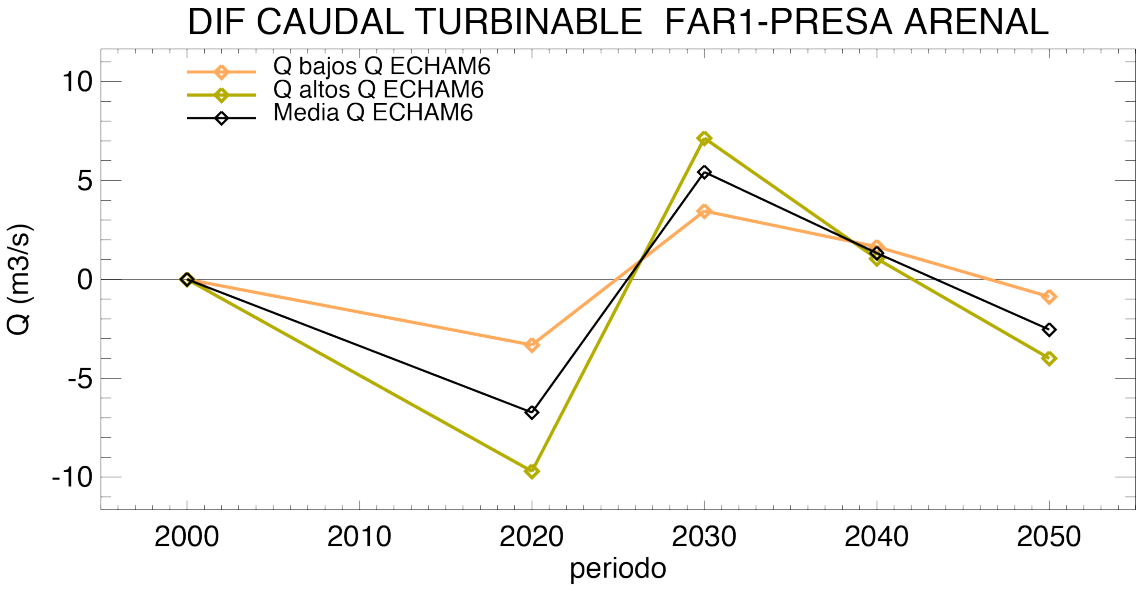

DIF CAUDAL TURBINABLE 0909-ORIENTE
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
5
0
-5
2000
2010
2020
2030
2040
2050
periodo

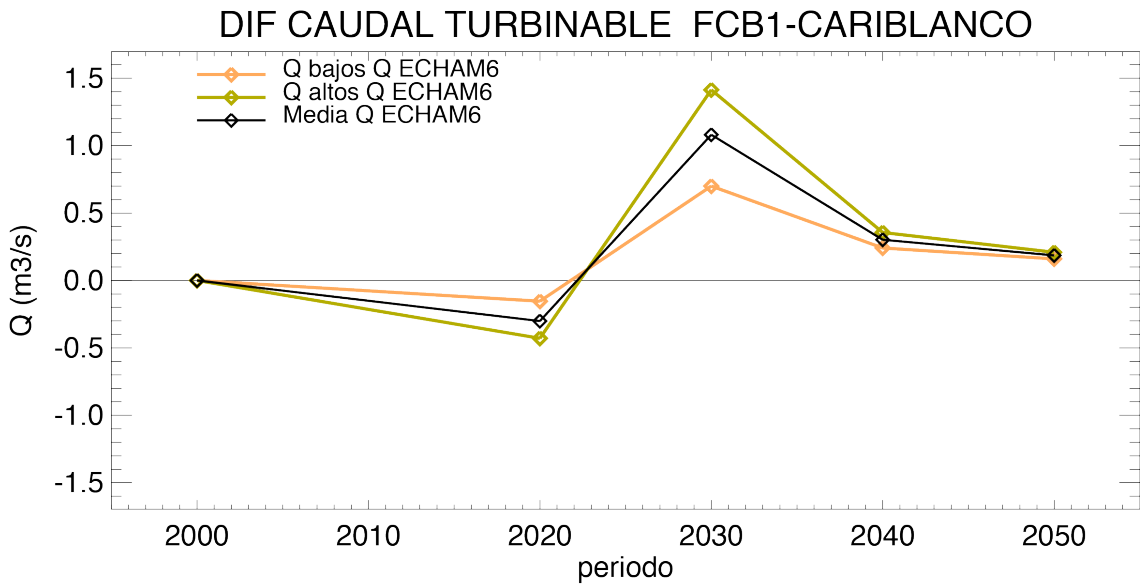

DIF CAUDAL TURBINABLE 0912-PASCUA
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
periodo

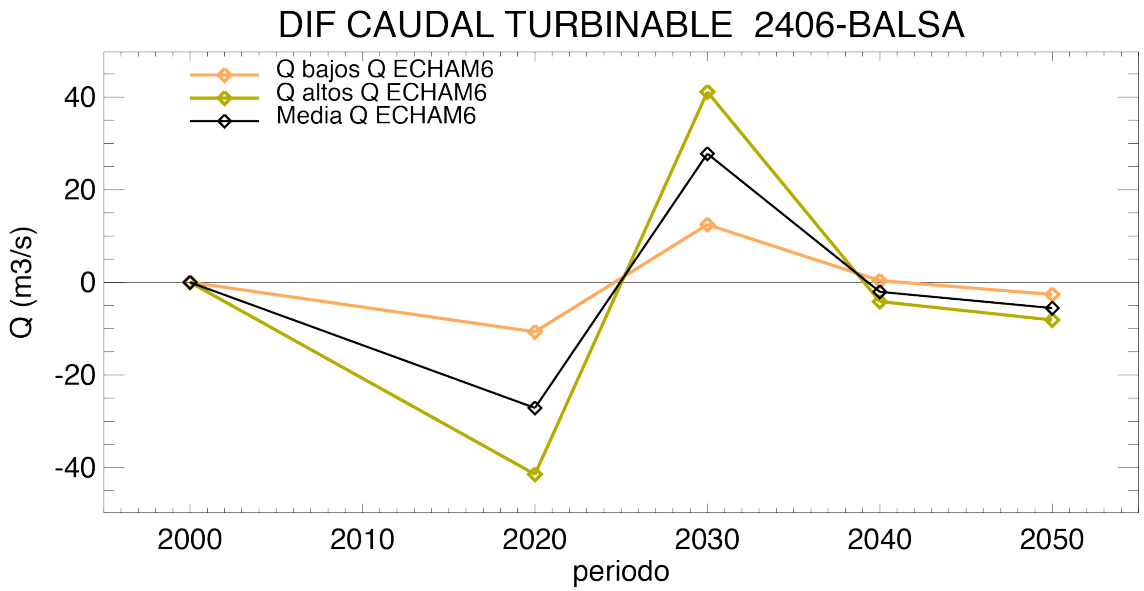

DIF CAUDAL TURBINABLE F001-TORO1
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
4
2
0
-2
-4
2000
2010
2020
2030
2040
2050
periodo

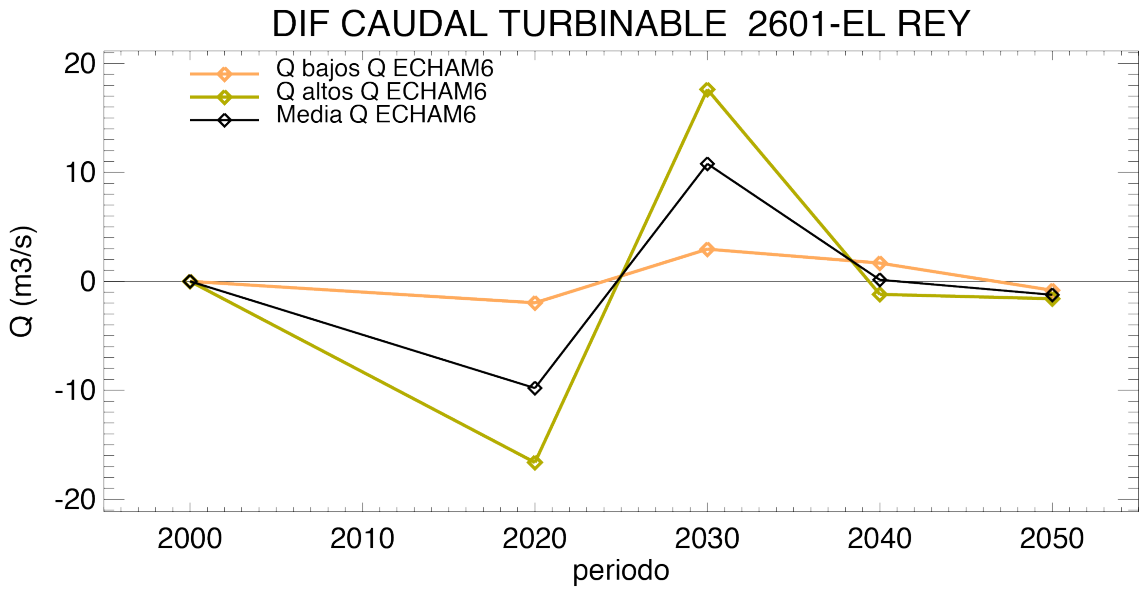

DIF CAUDAL TURBINABLE 1431-PEÑAS BLANCAS
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
5
0
-5
2000
2010
2020
2030
2040
2050
periodo

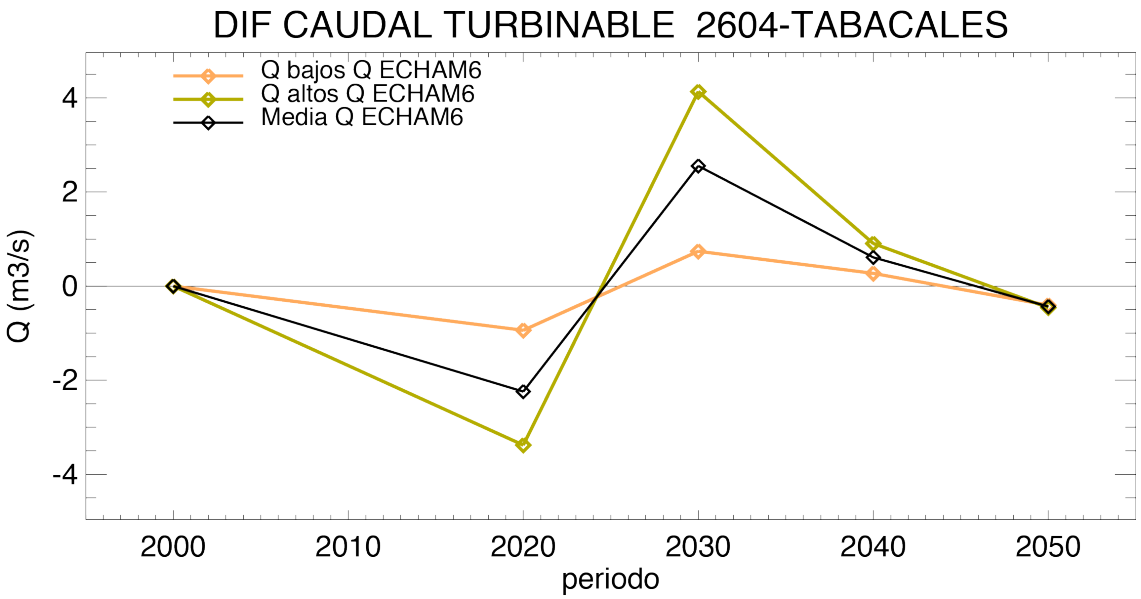

DIF CAUDAL TURBINABLE 2801-LONDRES
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
15
10
5
0
-5
-10
-15
2000
2010
2020
2030
2040
2050
periodo

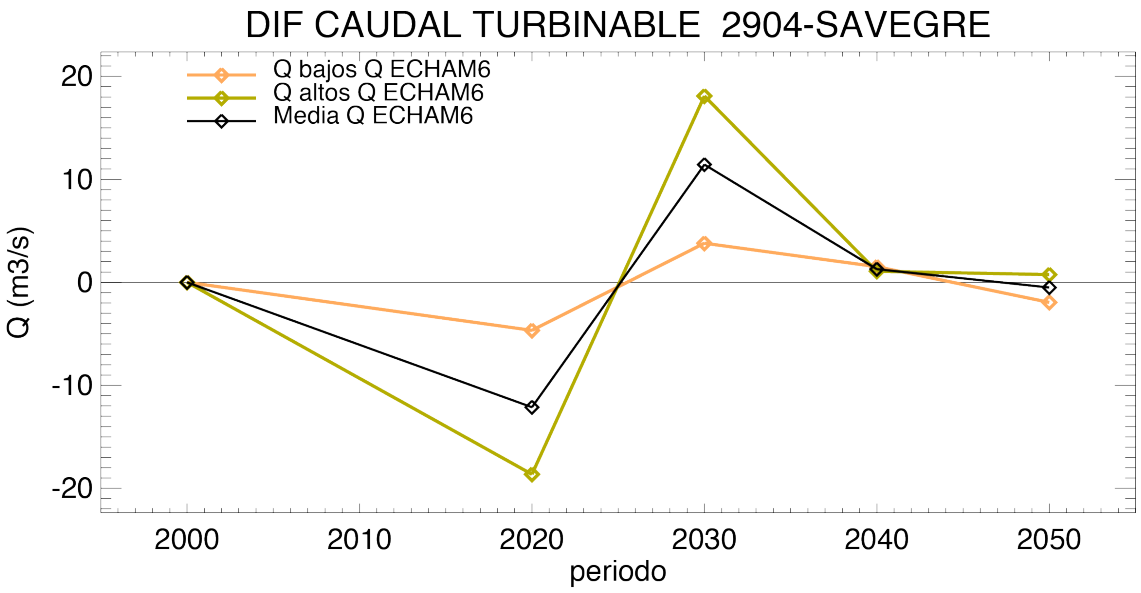

DIF CAUDAL TURBINABLE FAR1-PRESA ARENAL
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
periodo

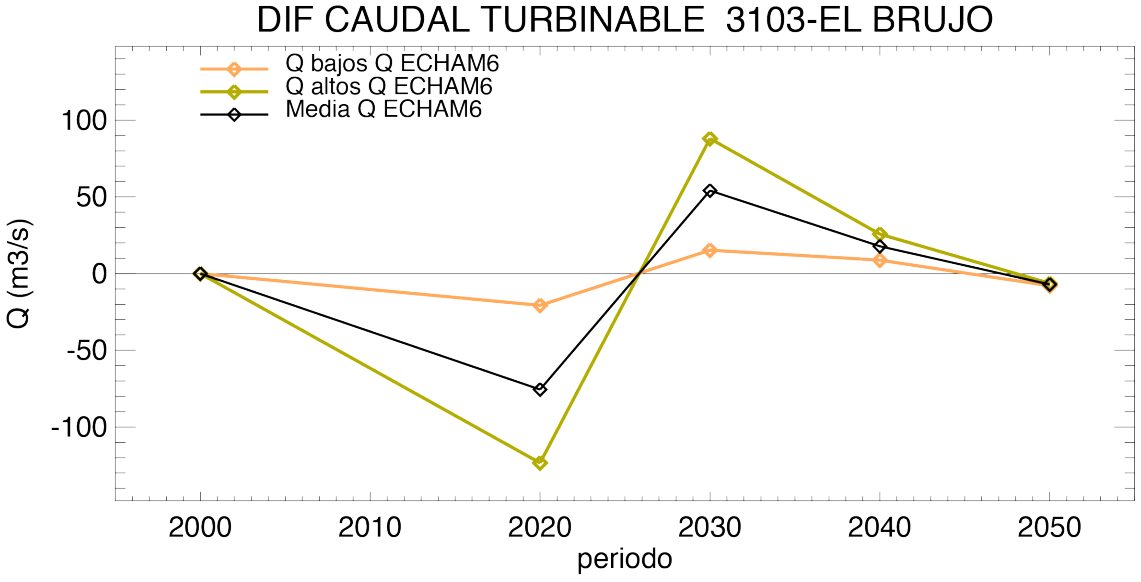

DIF CAUDAL TURBINABLE FCB1-CARIBLANCO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
2000
2010
2020
2030
2040
2050
periodo

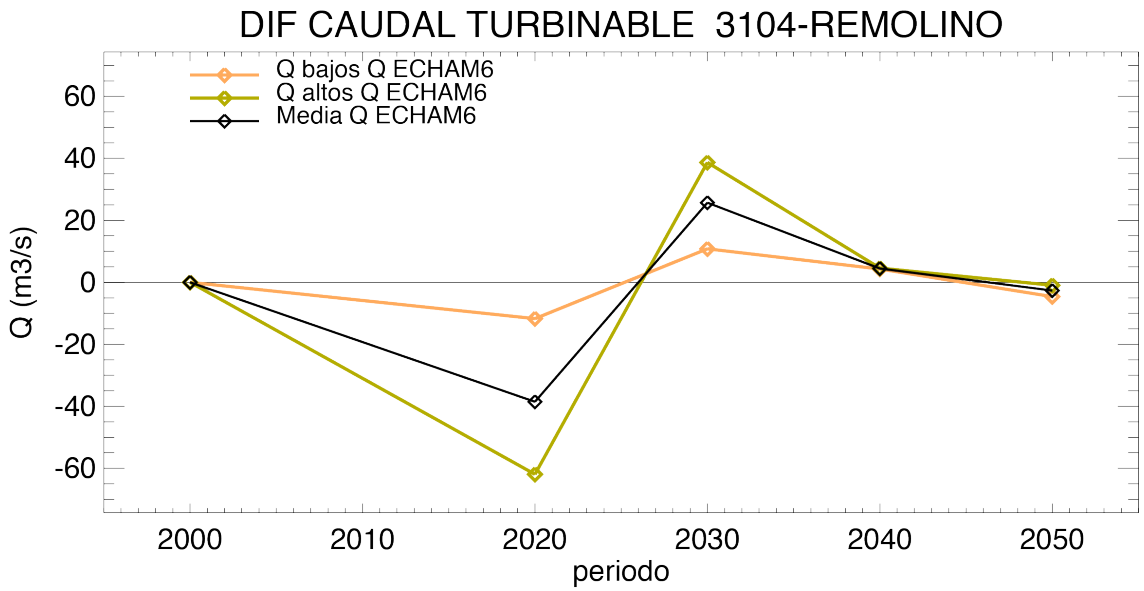

DIF CAUDAL TURBINABLE 2406-BALSA
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
40
20
0
-20
-40
2000
2010
2020
2030
2040
2050
periodo

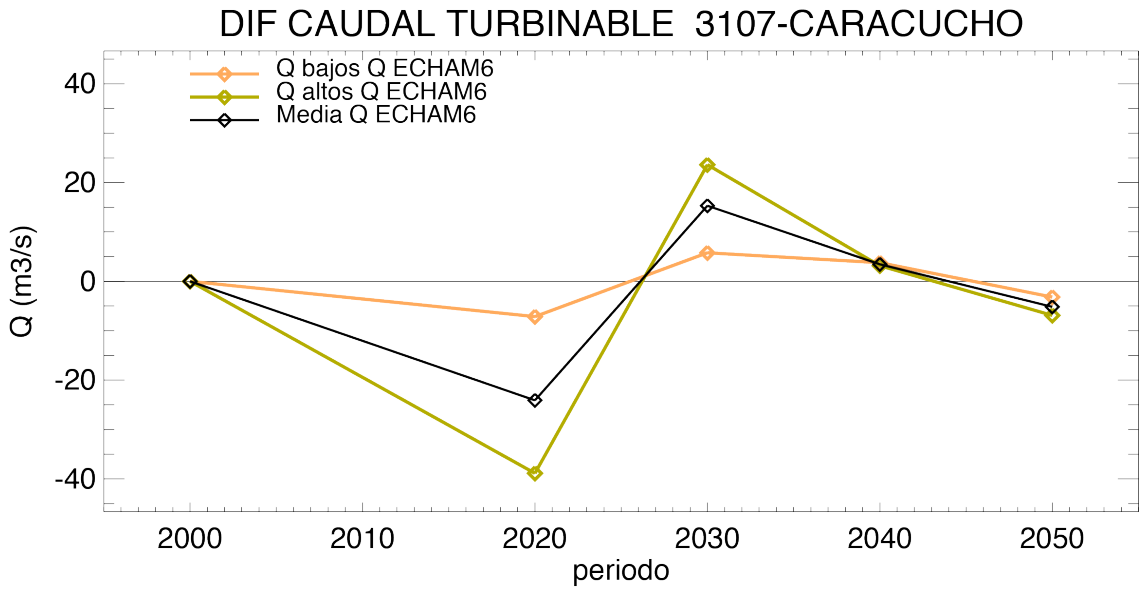

DIF CAUDAL TURBINABLE 2601-EL REY
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
20
10
0
-10
-20
2000
2010
2020
2030
2040
2050
periodo


DIF CAUDAL TURBINABLE 2604-TABACALES
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
4
2
0
-2
-4
2000
2010
2020
2030
2040
2050
periodo

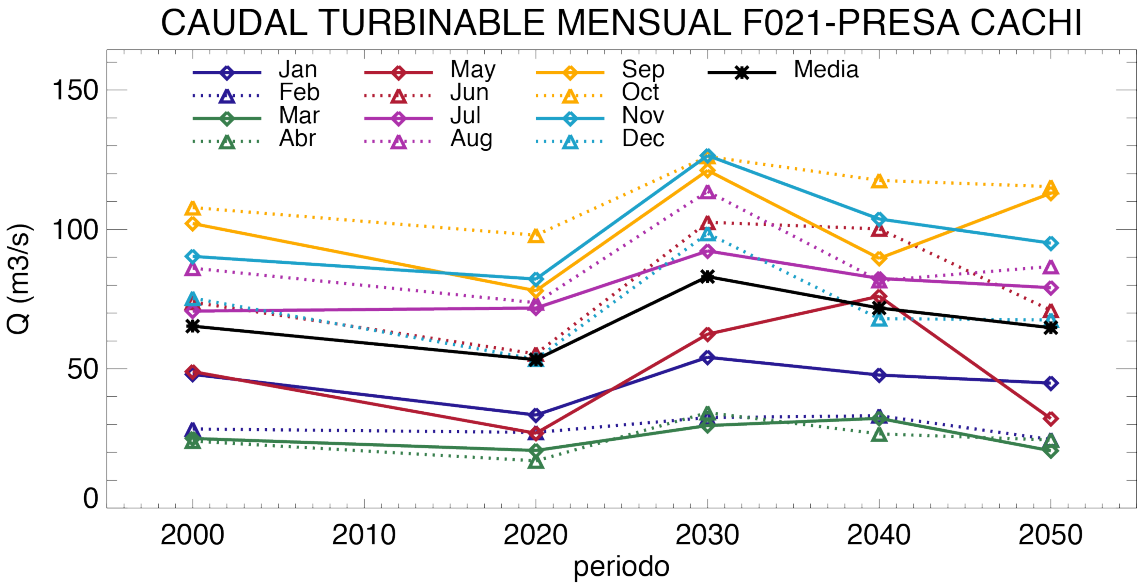

DIF CAUDAL TURBINABLE 2904-SAVEGRE
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
20
10
0
-10
-20
2000
2010
2020
2030
2040
2050
periodo

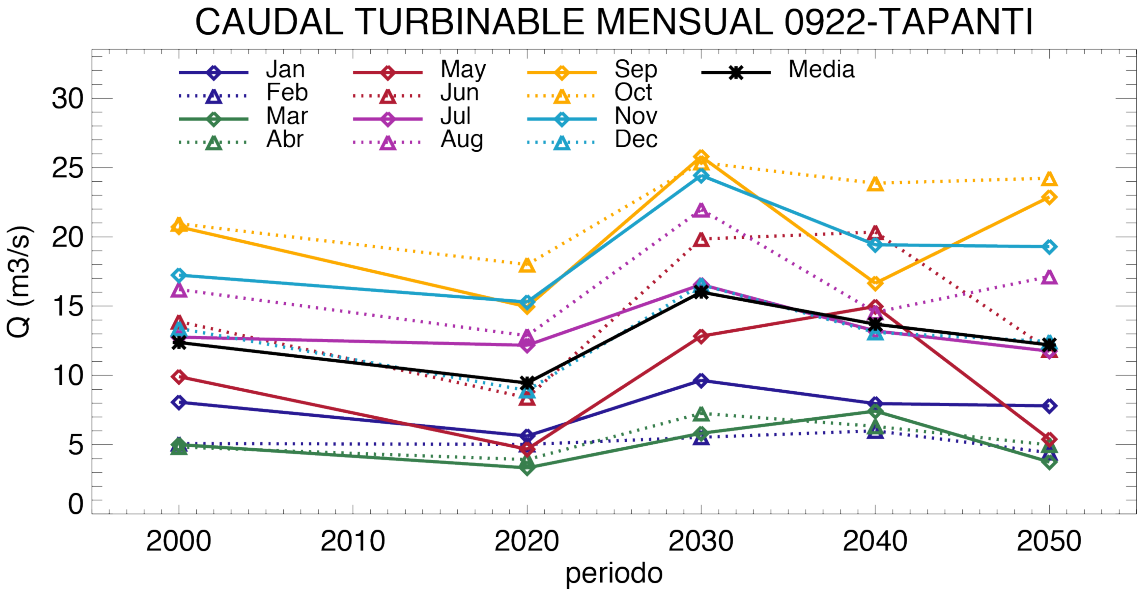

DIF CAUDAL TURBINABLE 3103-EL BRUJO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
100
50
0
-50
-100
2000
2010
2020
2030
2040
2050
periodo

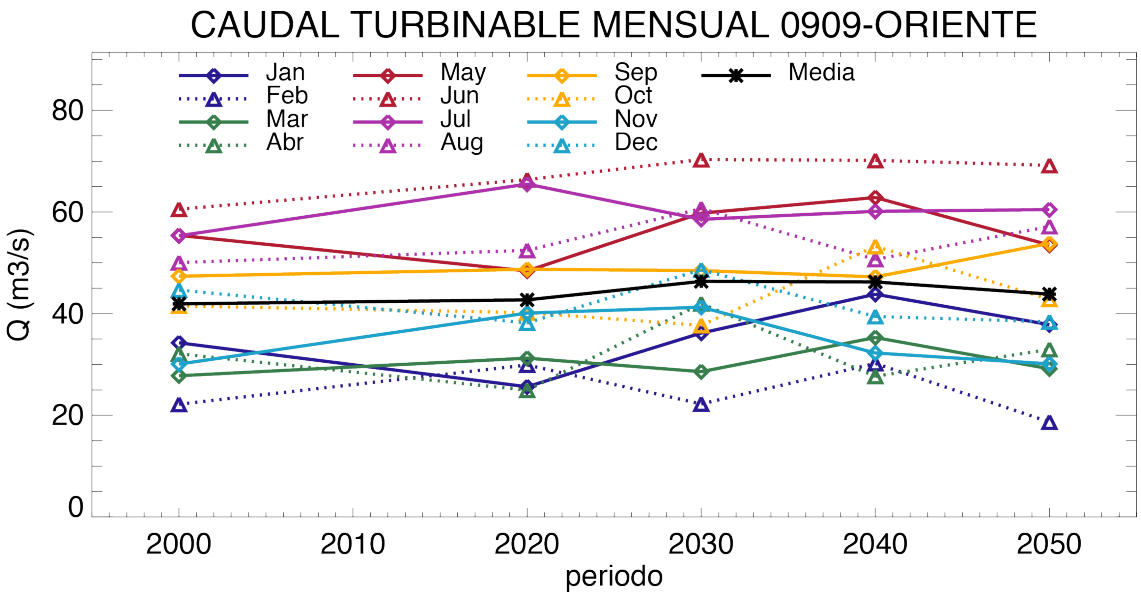

DIF CAUDAL TURBINABLE 3104-REMOLINO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
60
40
20
0
-20
-40
-60
2000
2010
2020
2030
2040
2050
periodo

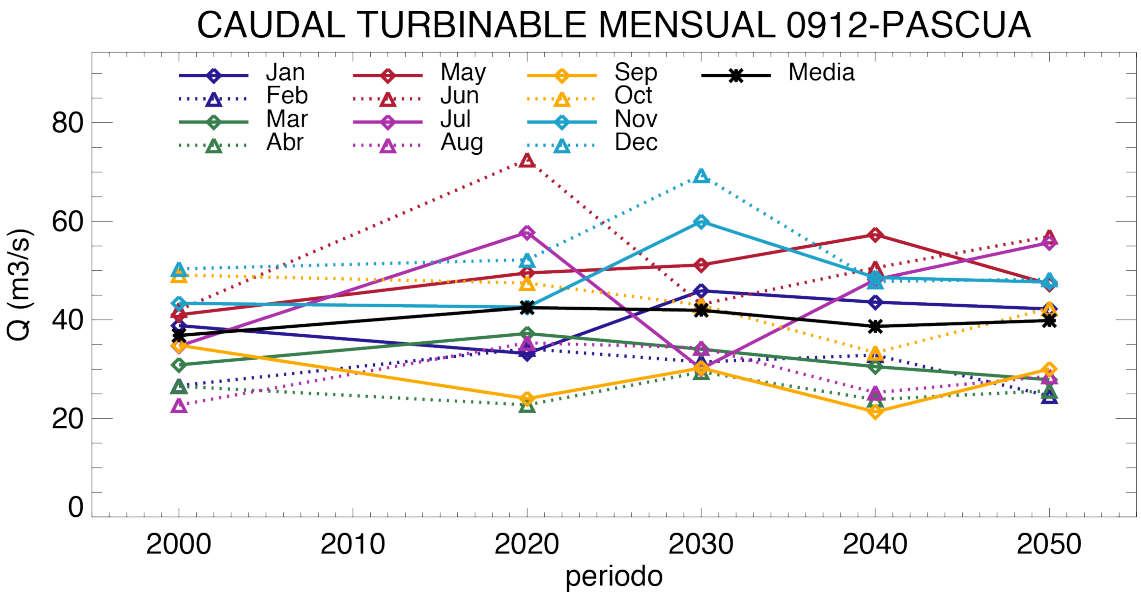

DIF CAUDAL TURBINABLE 3107-CARACUCHO
Q bajos Q ECHAM6
Q altos Q ECHAM6
Media Q ECHAM6
Q (m3/s)
40
20
0
-20
-40
2000
2010
2020
2030
2040
2050
periodo

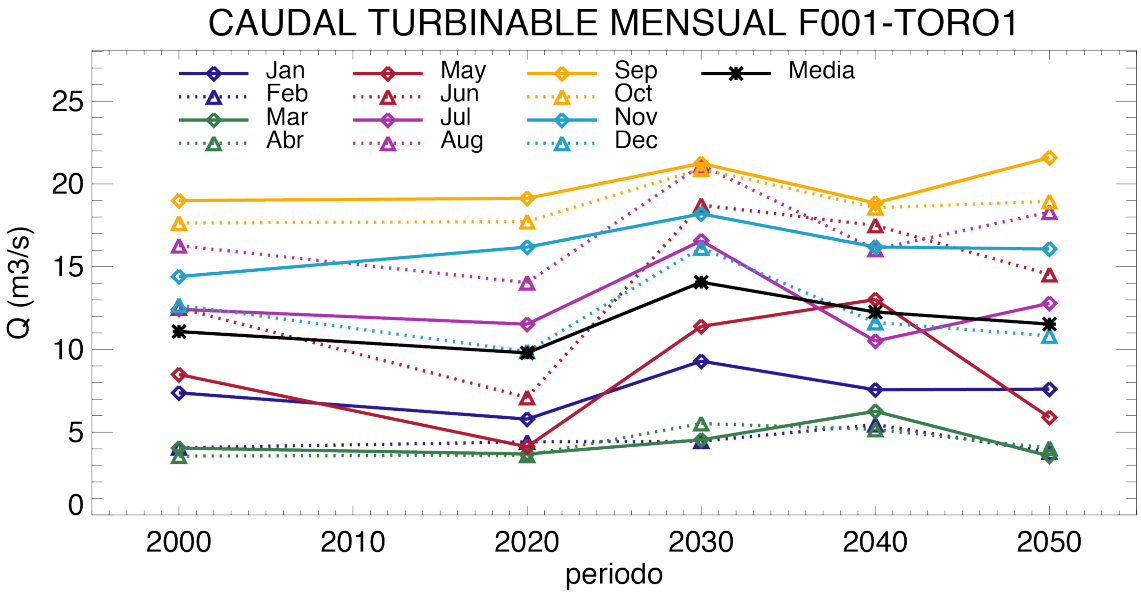
Anejo 10: Figuras de caudal turbinable medio mensual

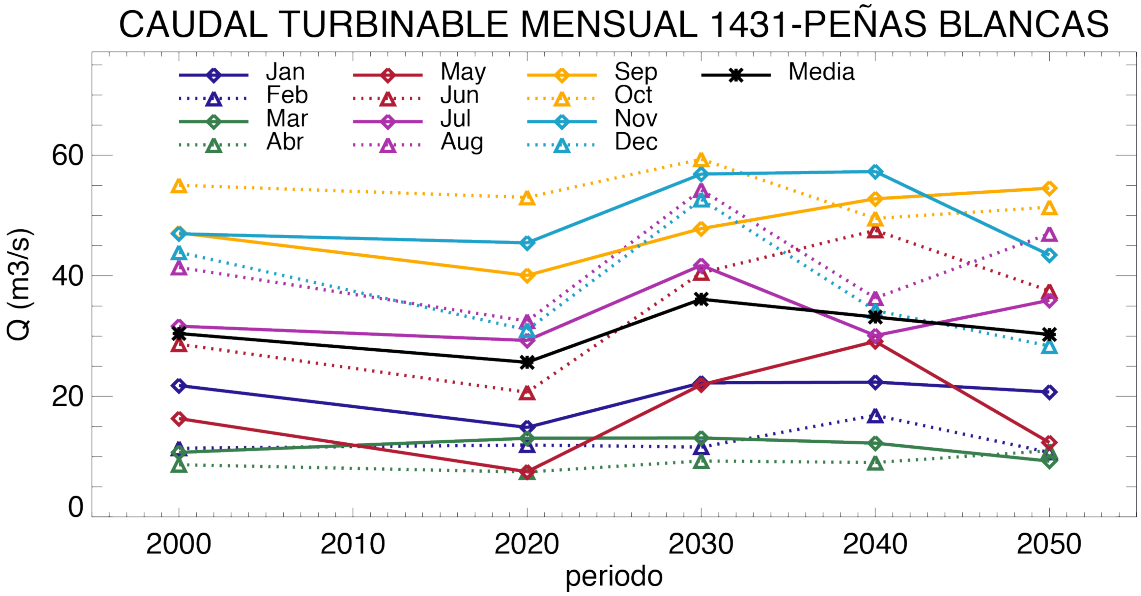


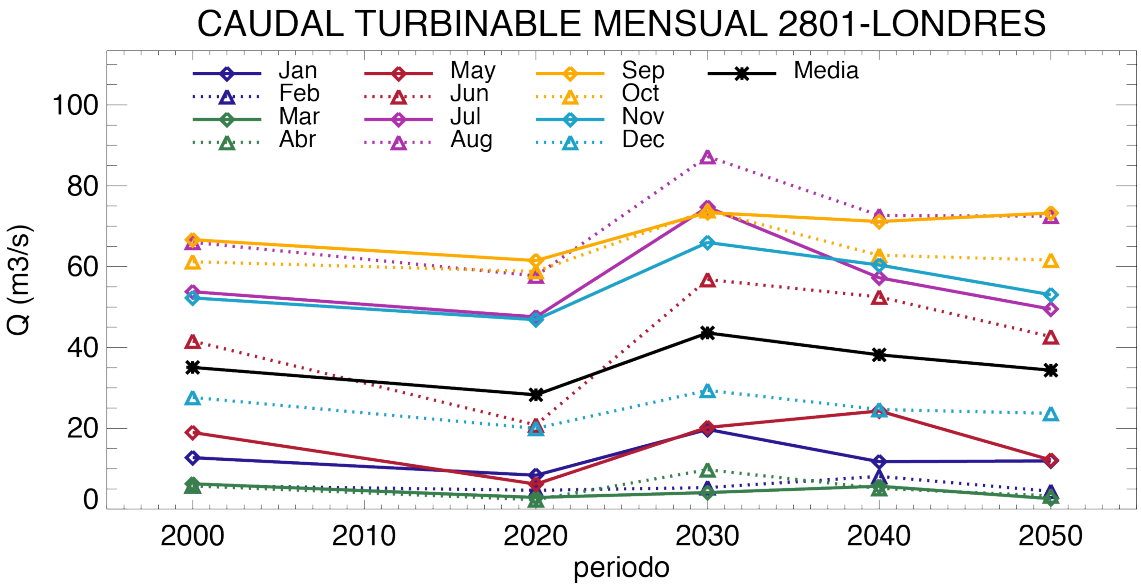


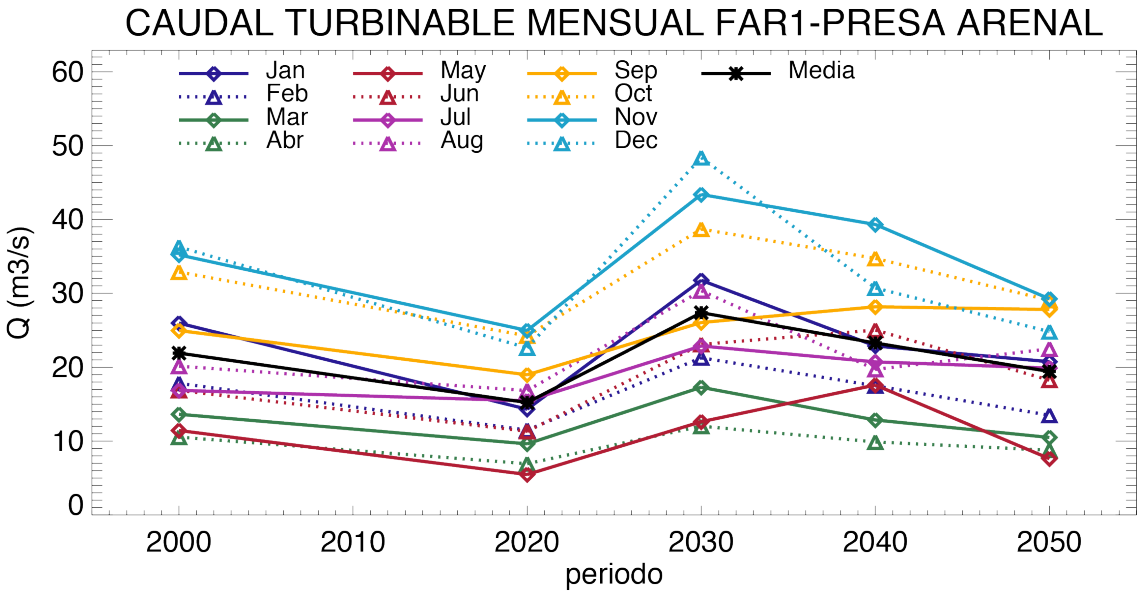

CAUDAL TURBINABLE MENSUAL 0909-ORIENTE
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

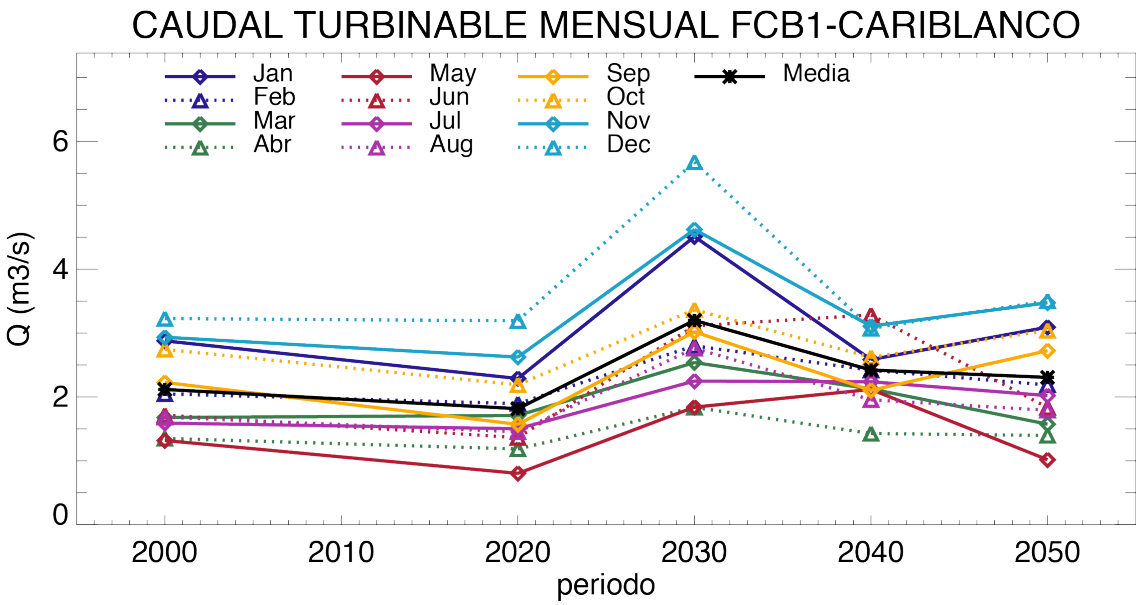

CAUDAL TURBINABLE MENSUAL 0912-PASCUA
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo

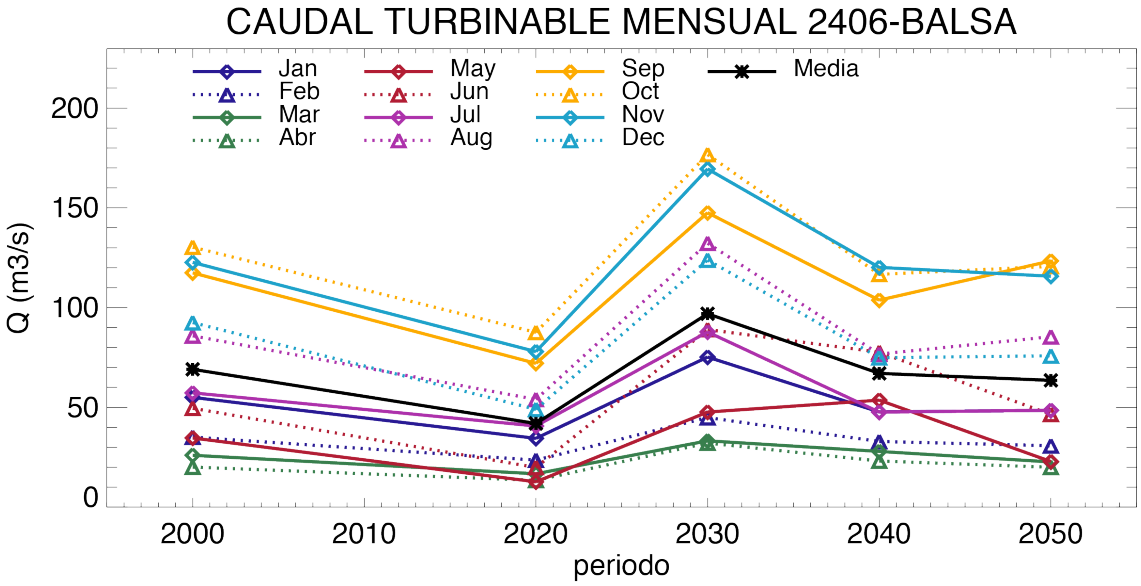

CAUDAL TURBINABLE MENSUAL F001-TORO1
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
5
10
15
20
25
2000
2010
2020
2030
2040
2050
periodo

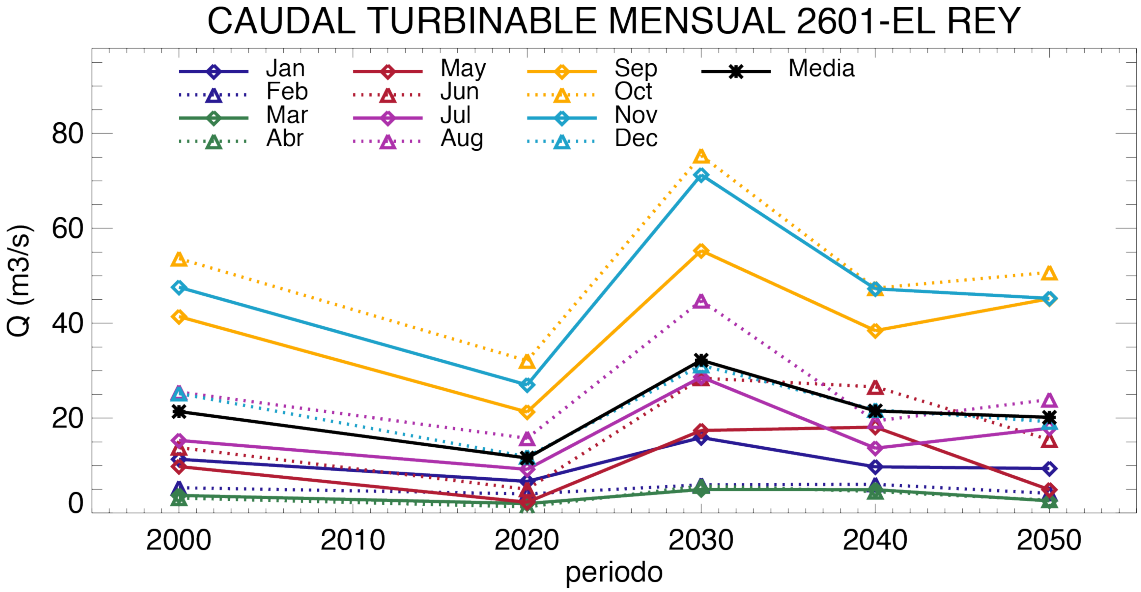

CAUDAL TURBINABLE MENSUAL 1431-PEÑAS BLANCAS
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
20
40
60
2000
2010
2020
2030
2040
2050
periodo

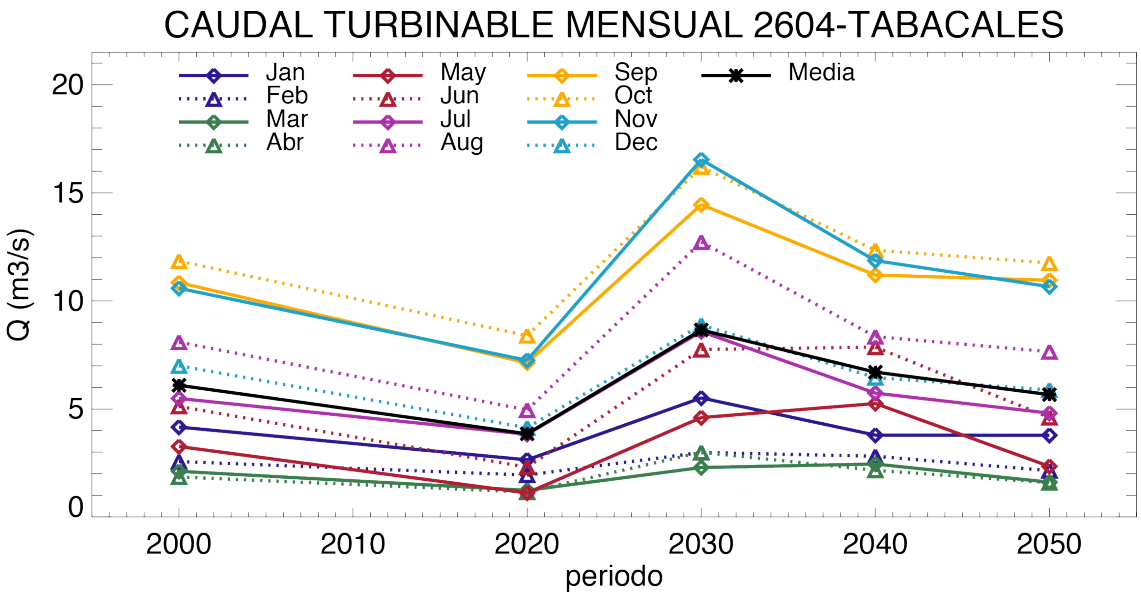

CAUDAL TURBINABLE MENSUAL 2801-LONDRES
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
20
40
60
80
100
2000
2010
2020
2030
2040
2050
periodo

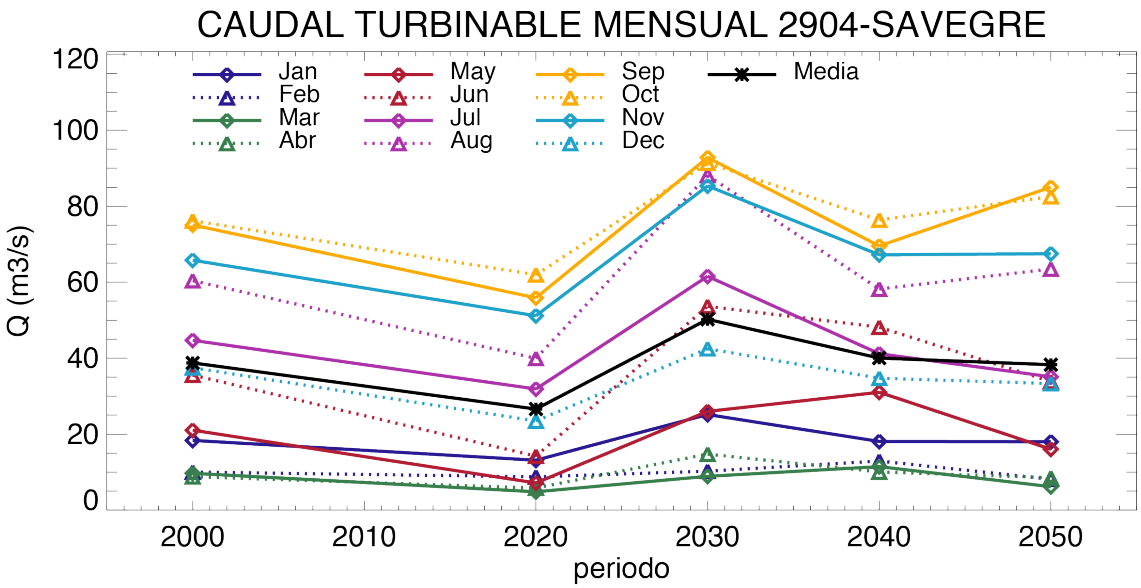

CAUDAL TURBINABLE MENSUAL FAR1-PRESA ARENAL
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
10
20
30
40
50
60
2000
2010
2020
2030
2040
2050
periodo

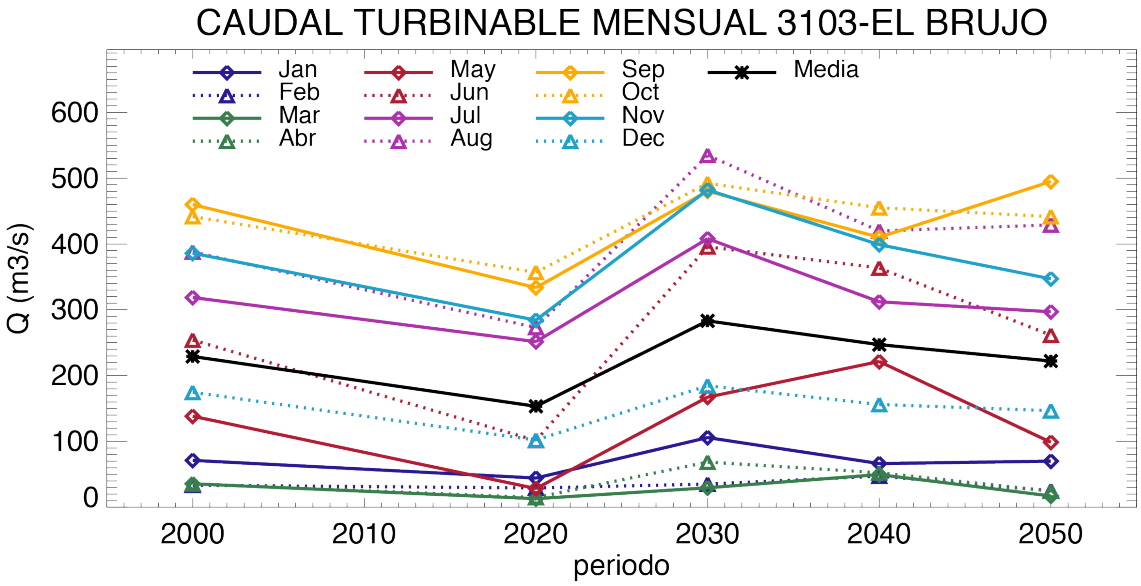

CAUDAL TURBINABLE MENSUAL FCB1-CARIBLANCO
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
2
4
6
2000
2010
2020
2030
2040
2050
periodo

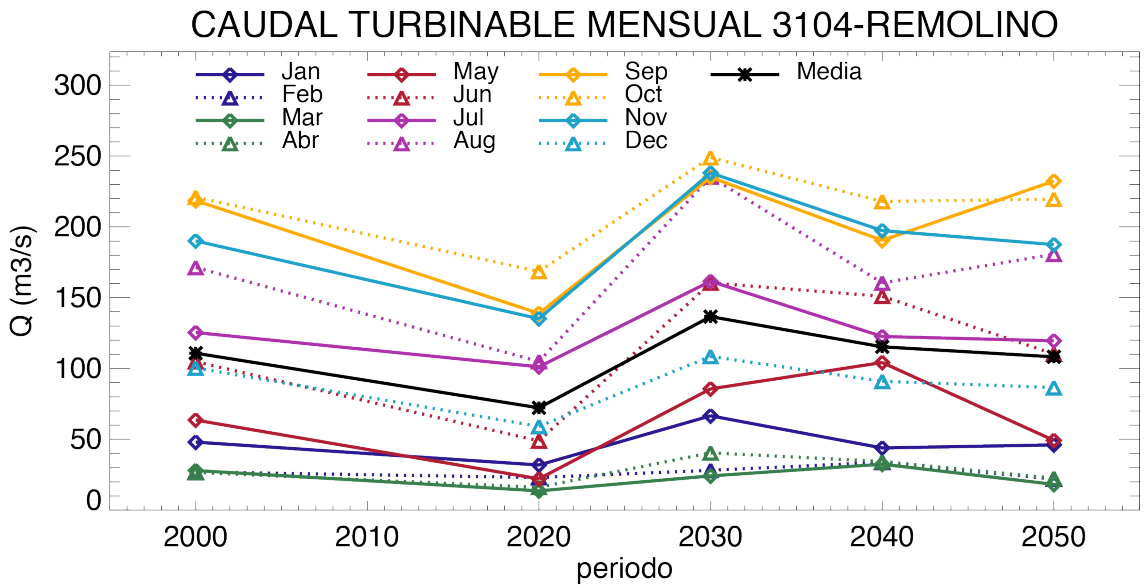

CAUDAL TURBINABLE MENSUAL 2406-BALSA
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
50
100
150
200
2000
2010
2020
2030
2040
2050
periodo

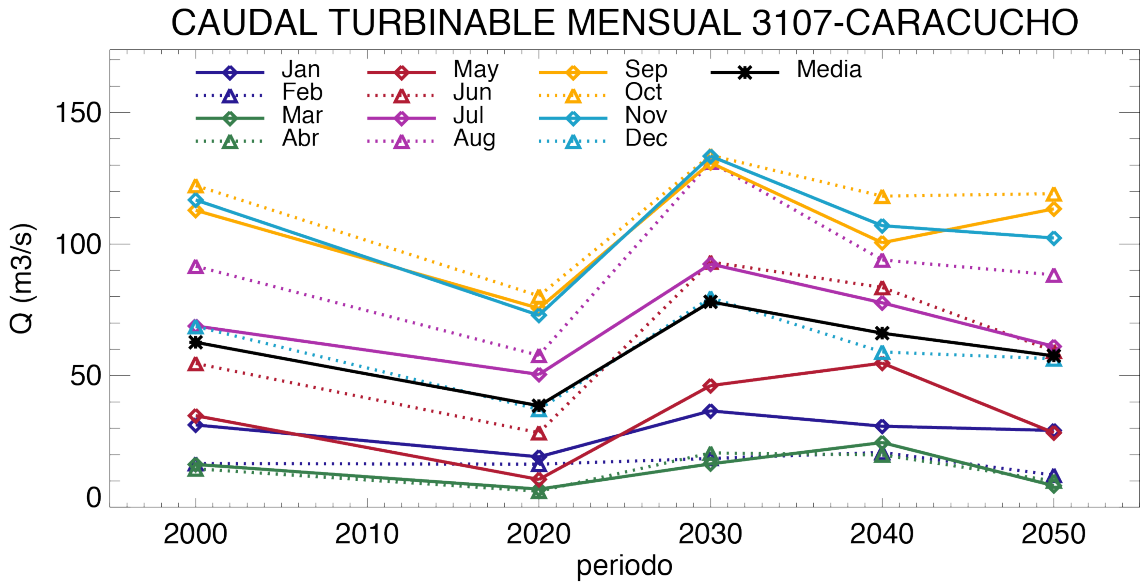

CAUDAL TURBINABLE MENSUAL 2601-EL REY
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
0
20
40
60
80
2000
2010
2020
2030
2040
2050
periodo


CAUDAL TURBINABLE MENSUAL 2604-TABACALES
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
periodo
0
5
10
15
20
2000
2010
2020
2030
2040
2050


CAUDAL TURBINABLE MENSUAL 2904-SAVEGRE
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
periodo
0
20
40
60
80
100
120
2000
2010
2020
2030
2040
2050


CAUDAL TURBINABLE MENSUAL 3103-EL BRUJO
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
periodo
0
100
200
300
400
500
600
2000
2010
2020
2030
2040
2050


CAUDAL TURBINABLE MENSUAL 3104-REMOLINO
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
300
250
200
150
100
50
0
2000
2010
2020
2030
2040
2050
periodo


CAUDAL TURBINABLE MENSUAL 3107-CARACUCHO
Jan
Feb
Mar
Abr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Media
Q (m3/s)
150
100
50
0
2000
2010
2020
2030
2040
2050
periodo